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Progress in Exploring the Applicability of Different Nutritional Screening Methods to Alveolar Echinococcosis

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Abstract: Alveolar echinococcosis, as a chronic wasting disease with insidious onset, long course, high rate of disability and mortality, and poor prognosis in Northwest China, the nutritional status of patients tends to deteriorate, and nowadays, radical surgical treatment is considered to be the best therapeutic approach. However, accurate preoperative assessment of the patient's nutritional status is difficult. This often leads to increased postoperative complications, longer hospital stays and more financial burden. Currently, there are no clear national or international standards for nutritional screening. Therefore, the aim of this paper is to summarize the different types of preoperative nutritional screening methods currently in common use and to assess their applicability in patients with Alveolar echinococcosis.

1. Introduction

Alveolar echinococcosis, as a common disease in highland pastoral areas, is distributed in all regions of the world, and as early as 323 B.C.E., Nozais JP suggested that encapsulated disease might be transmitted by dromedary camels via the Sahara Desert. In China, it is mainly prevalent among farmers and herdsmen in the northwestern region, and was first reported by Xu Mingqian in the Chinese Journal of Surgery in 1995 [1]. The main types of human infection are cystic echinococcosis (CE) and alveolar echinococcosis (AE) [2] Multilocular echinococcosis is the most serious. Due to its insidious onset, it often invades the human liver first and is characterized by invasive growth and metastatic spread [3] often accompanied by vascular and lymphatic vessel infiltration and distant organ metastasis [4]. When the host presents with symptoms such as pain or jaundice, it is often in the advanced stage of the disease, so it is aptly called "worm cancer". It has a high lethality and disability rate and poor prognosis [5], which seriously jeopardizes physical health and increases economic burden. Currently, radical resection is still the best treatment method[6] Nutrition is defined as a condition characterized by deficiencies, excesses, or imbalances of energy, protein, and/or other nutrients that have a markedly adverse effect on body morphology (body shape, size, and composition), body function, and clinical outcomes.[7]. As the disease is a chronic wasting liver disease, often due to disturbances in nutrient metabolism caused by liver involvement, it has been

shown that wasting with fatigue was found in 21 out of 141 patients admitted to the hospital, accounting for 17.8% of the cases. [8].The nutritional status of patients after admission affects intraoperative tolerance and postoperative recovery. Malnourished patients are at increased risk of postoperative complications after major abdominal surgery, so patients' nutritional risk should be carefully and thoroughly examined preoperatively [9]. Clinical interventions to improve the nutritional conditions of patients reduce the probability of complications and recurrences and improve the prognostic quality of life. Because there is no recognized gold standard for nutritional screening methods for AE patients, this article will compile a review of recent studies on several preoperative nutritional screening indicators with different focuses and forms that can be applied to AE patients.

2. Subjective comprehensive nutrition assessment method

2.1 Subjective global assessment (SGA) and mini nutritional assessment (MNA)

As a nutrition questionnaire evaluation method proposed in the 1980s, SGA has been recognized by most international nutrition societies, such as the American Society of Parenteral and Enteral Nutrition (ASPEN) and the Australian Dietitians Association (DAA) [10], and has a certain degree of response to changes in liver disease [11]. However, it is only suitable for some clinical situations, and its specificity is strong but its sensitivity is not ideal. The scoring version of the subjective overall assessment may have advantages, and the usefulness of this tool needs to be further extended [12]. MNA (Table 2), which has been in use for 20 years, is more applicable to the elderly population, where the incidence of malnutrition caused by this tool is related to the degree of dependence. However, the sensitivity of MNA remains controversial because it is associated with a high risk of "overdiagnosis" [13]. However, domestic studies have shown that its malnutrition detection rate of 79.69% is much higher than that of SGA 20.31%[14].However, most AE patients have strong ethnic and regional characteristics and low educational level. The content of these two questionnaires is too long, the time cost is high, and the subjective evaluation is strong. It is not well used in the evaluation of patients with AE.

2.2 Nutritional risk screening 2002 (NRS 2002)

NRS-2002 was developed by Kondrup et al. [15] to detect nutritional risk. NRS was validated in a nutritional support trial in hospitalized patients. It has also been used in cancer outpatient diagnosis as a flexible tool that only considers weight loss and food intake, both of which are readily available [16]. It stands out because it has a good correlation with anthropometric and biochemical parameters (including mortality prediction), and it is fast, easy to use, inexpensive and has a higher efficacy compared to other protocols [17]. In addition, it can be evaluated by weight change in patients within nearly 3 months, reduction in dietary intake within a week and severity of disease. This has high specificity and applicability for patients with different clinical conditions [18]. At present, this index has been widely used in the preoperative evaluation of patients with liver cancer (LC), which can effectively screen the nutritional status of patients with LC and prove that it is closely related to the prognosis [19,20]. Although it has not been involved in foreign countries, domestic scholars [21] have predicted the postoperative complications of AE patients through the combination of MNA (micro-nutritional evaluation method), and concluded that the combined index has more predictive value than the single index. Because the two assessments have different nutritional evaluation observation focuses, they are generally consistent in terms of degree. In view of the simplicity of the score, it focuses on the weight changes and food intake of patients, which is consistent with the changes after the progression of AE patients, and has a good judgment value. Of course, this score itself is also subject to the bias of the evaluator's subjective judgment, which leads to the omission or misjudgment

of the preoperative nutritional status of patients. It is recommended that multiple screening be conducted to restore the true nutritional status of patients as much as possible.

3. Objective nutritional assessment indicators for laboratory tests

3.1 PNI prognostic nutritional index and inflammatory index.

PNI is an indicator for comprehensive nutritional evaluation. It was first proposed by Gordon P.Buzby MD in 1980. The multi-parameter indicator of nutritional status for non-emergency patients, which is associated with the risk of postoperative complications and the baseline nutritional status [22], is calculated as follows: PNI= preoperative serum albumin (g/L) +5 x preoperative lymphocyte count (109 /L). As a simple and feasible nutritional indicator, PNI has been increasingly used to predict the prognosis of different cancers and to evaluate perioperative complications, such as gastric cancer, breast cancer, kidney cancer, etc., which has been confirmed as an independent risk factor affecting the prognosis. Among them, Ping'an Ding et al. included inflammation indicators in gastrointestinal tumors that directly affected patients' nutritional intake for joint prediction, which to some extent made up for the deficiency of PNI [23,24,25]. According to the relevant research data of AE patients abroad, the susceptible host will cause abnormal immune and inflammatory responses in the body, and under the influence of regulatory TCD4+FoxP3+ lymphocytes (Treg) and IL-10 secretion, the pro-inflammatory Th1/Th17 immune response gradually changes to Th1/Th2 mixed response. The parasite survives [26]. The systemic immunoinflammatory index (SII) is now used to evaluate the prognosis of AE patients, and it is concluded that the higher the SII index in peripheral blood, the worse the prognosis of patients, confirming that the inflammatory index in peripheral blood of patients before surgery is closely related to the prognosis of AE [27]. Chen Xiaobin et al. [28] used PNI to evaluate preoperative nutrition and immune function of AE patients. They further optimized the outcome based on survival time through X-tile and determined that the best cutoff value was 32.4. According to the cutoff value, they divided the two groups into different scores for comparison. This coincides with its application in the field of oncology. These two articles provide a good reference for the preoperative nutritional assessment of AE. We can further systematically evaluate the mechanism of malnutrition caused by AE and use PNI in combination with other indicators for post-admission patients.

3.2 Controlling Nutritional Status (CONUT) Controlling nutritional status (CONUT)

The CONUT score was originally reported in 2005 by [29] Ignacio et al as underreported due to malnutrition in hospitals and was therefore proposed as a simple and cost-effective tool to screen for early malnutrition. Indicators can be obtained through laboratory examination, objective and accurate, eliminating the subjectivity of the investigation. Serum albumin, total cholesterol level and total lymphocyte count were collected one week before surgery, and the sum of the scores obtained according to the scale was the CONUT score of the patient. Among them, serum albumin is the most important protein in human plasma, which maintains body nutrition and osmotic pressure [30] and has been used as an indicator of clinical nutritional status for decades, often reducing in the case of malignant wasting diseases such as malignant tumors and malnutrition. Total cholesterol has been confirmed in more than 40,000 patients with cardiovascular diseases. It plays an important role in malnutrition [31]. When malnutrition occurs, this index is significantly reduced, which is related to the increased demand for energy-rich compounds during the progression of cachexia [32]. Total lymphocyte count refers to the different types of white blood cells are counted separately and the percentage is calculated. Lymphocyte count < 1500 often indicates malnutrition. The above three indicators are closely related to nutritional status, and CONUT score is formed by the sum of certain

scores, which has been proved to predict the clinical outcome of various diseases and has been recognized by experts and scholars at home and abroad [33,34,35]. These indicators can be obtained through laboratory tests, the calculation of the score is simple, the grading is clear, and the control is strong. However, it is difficult to find the trace of CONUT score in the study of AE. According to the characteristics of AE affecting host liver metabolism and immune function, this score has strong applicability and great research potential in AE patients, but it has not been well verified in AE patients, and its clinical value needs to be further demonstrated.

4. Objective nutritional assessment methods for anthropometric indicators

4.1 BMI

Body Mass Index (BMI) is a statistical index that uses a person's weight and height to estimate the body fat of men and women of any age. It is calculated as weight in kilograms/height squared in meters [36]. But BMI, which varies from individual to individual, is not enough to be the only means of classifying a person as obese or malnourished. There are significant differences between different ethnic groups and different physical fitness groups, such as elite athletes and bodybuilders, because their muscle mass and weight gain will mistakenly increase their BMI and does not necessarily reflect the changes that occur with age [37]. However, AE patients have strong regional and are mostly patients living in high-altitude pastoral areas for a long time [38]. Due to their dietary structure (lack of intake of fresh fruits and vegetables)[39], living habits and exercise intensity, As a result, the actual BMI of patients in this area is generally higher than the actual nutritional level. In addition to BMI, the proportion of body fat increases with age and muscle mass decreases with age, but the corresponding changes in height, weight, and BMI may not reflect changes in body fat and muscle mass with age. This results in poor sensitivity and specificity of BMI [40]. Although it has been found in China that BMI < 20.33 kg/m2 is a risk factor for poor prognosis of AE patients after radical resection [41], due to the small sample size and relatively simple evidence, it has certain reference value, but cannot be used as a strong proof of the correlation between BMI and the prognostic value of AE.

4.2 Skin fold thickness (TSF), upper arm muscle circumference (MAMC), upper arm muscle area (MAMA), calf gastrocnemius circumference (CC).

In clinical practice, we often introduce four basic anthropometric indicators of hospitalized patients, namely TSF, MAMC, MAMA and CC, for preoperative nutritional evaluation of patients for joint evaluation with BMI [10]. But given that patients with AE typically have a long course of disease, severely impaired liver function, chronic pain, and prolonged bedridden condition, it can lead to fat loss and muscle atrophy, which is common in patients with AE. These four indices are typically lower in patients with AE at admission than in age-matched healthy individuals, indicating a negative clinical outcome. Because AE patients are often located at different altitudes, and considering the different thickness of subcutaneous fat in different populations, there is no uniform standard for the above indicators. [42] Therefore, it can only be used as a reference index and has no specificity. Appropriate modification is still needed for AE patients at different altitudes, but few studies have been conducted.

5. Summary and outlook

As a chronic wasting parasitic infection with a long course of disease with regional characteristics [43], AE patients with malnutrition can be accurately screened at the time of admission, and

appropriate nutritional support can prevent many complications and poor prognosis caused by surgery to a large extent. At present, there is no uniform nutritional screening index and standard for AE patients at home and abroad. However, the combination of different types of nutrition screening indicators for multiple assessments can avoid misjudgment and missed judgment to the greatest extent. Secondly, a set of individualized and scientific perioperative management is developed for different populations and their past medical history in different regions, which can effectively shorten the length of hospitalization, reduce the medical burden and improve the quality of life. However, this will inevitably increase the workload of medical staff and reduce work efficiency. With the advent of message queuing technology (Websphere MQ), this problem can be solved. The establishment of a complete system connecting hospital information System (HIS) [44,45] can avoid repeated marks in different evaluation methods, accurately detect malnourished AE patients, and complete preoperative nutritional screening more efficiently. At present, with the efforts of domestic scholars, preoperative NRS2002 and PNI have been proved to be closely related to the prognosis of AE patients. CONUT scores are also derived from objective laboratory test metrics that are not currently covered. CONUT scoring, as a simple, fast and efficient scoring standard, has been widely recognized both at home and abroad through the practice and research of many scholars. It has highlighted its value in evaluating the prognosis of patients with malignant tumors. It is believed that with the deepening of AE research and the increasing attention to the nutritional status of patients, many nutritional screening indicators, including CONUT score, will be more studied and applied in AE patient

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