Applied Nursing Research 30 (2016) 142–147

Contents lists available at ScienceDirect

Applied Nursing Research

journal homepage: www.elsevier.com/locate/apnr

Nutritional status survey of aplastic anemia patients - a single center experience in China

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ARTICLE INFO

Article history:
Received 2 July 2015
Revised 30 August 2015
Accepted 6 September 2015

Keywords:
Aplastic anemia
Nutritional status
Dietary guidance
Health education

ABSTRACT

Aims: To analyze the nutritional status of aplastic anemia (AA) patients.
Methods: The nutrition-related anthropometric indicators and blood biochemical index of 622 newly-diagnosed AA patients were retrospectively analyzed.
Results: Of the cohort of AA patients, body mass index of non-severe AA (NSAA) patients were higher than those of severe AA (SAA) ($p < 0.05$). The serum total protein and albumin protein levels of SAA patients differed from those of NSAA, and lower hemoglobin was correlated with lower serum albumin protein concentration ($p < 0.01$). The concentration of B vitamins (folic acid and vitamin B_{12}) of urban patients significantly differed from rural ones ($P < 0.01$). Of the 97 cases of iron overload (15.6% of the entire patient group), the iron overload rate of SAA patients (19.1%) was much higher than that of NSAA (8.1%).
Conclusions: AA patients exhibited malnutrition conditions; it would be helpful to conduct individualized dietary guidance and health education for patients.

1. Introduction

Aplastic anemia (AA) consists of a series of clinical syndromes of pancytopenia that were caused by bone marrow failure due to various reasons; it could occur in all age groups (Marsh et al., 2009). The blood hemoglobin (Hb) indicator of AA patients is less than the minimum value for a normal population of the same age and sex, which causes reduced oxygen-carrying capacity and affects the proper function of various body systems. At the beginning of medical treatment, most patients exhibit varying degrees of loss of appetite, bloating, nausea and other symptoms, and many patients may experience significant weight loss. Although studies have not clarified whether AA patients need nutrition support therapy (Jia et al., 2011), nutritional deficiency conditions caused by AA disease, such as increased consumption and decomposition of muscle cells and reduced appetite, should be seriously examined. None of the existing nutritional evaluation indicators completely reflected the nutritional status of AA patients, and a common standard for the screening of the nutritional status of hospitalized patients was still lacking (Platek et al., 2011). The majority of researchers recommend a comprehensive assessment based on various indicators, including anthropometric indexes and serological testing indicators.

We retrospectively analyzed the nutrition-related anthropometric indicators and blood test indicators of AA patients to investigate the nutritional and metabolic status of AA patients and to provide improved health education and dietary guidance for patients and theoretical help for clinical nursing care.

2. Patients and methods

2.1. Patients

All cases involved AA patients who were treated for the first time in Anemia Diagnosis and Treatment Center of Blood Diseases Hospital, Chinese Academy of Medical Sciences & Peking Union Medical College from February 2004 to March 2014. There were 622 cases total, with 345 males and 277 females; the median age of the patients was 21 (2–85) years. A total of 419 severe AA (SAA) cases and 203 non-severe AA (NSAA) cases were reviewed; the classification and diagnostic criteria were consistent with the literature (Camitta, Rappeport, Parkman, & Nathan, 1975). Upon admission, all patients were measured for height and weight. Fasting venous blood samples were obtained the next morning for measurements such as routine blood examination, blood biochemistry, serum iron four items, serum ferritin (SF), folic acid (FA), and vitamin B_{12} ($VitB_{12}$). Exclusion criteria: ① AA patients related

Abbreviations: AA, aplastic anemia; Alb, albumin protein; BMI, body mass index; FA, folic acid; Hb, hemoglobin; NSAA, non-severe AA; SAA, severe AA; SF, serum ferritin; SI, serum iron; TP, total protein; TS, transferrin saturation; UIBC, unsaturated iron binding capacity; $VitB_{12}$, vitamin B_{12}.

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http://dx.doi.org/10.1016/j.apnr.2015.09.003
0897-1897/

to hepatitis; ② patients showing signs of infection upon admission to the hospital; ③ patients with gastrointestinal-related diseases; and ④ patients with histories of FA or (and) $VitB_{12}$ supplementation prior to admission. The study was approved by the Ethics Committees of the Institute of Hematology, Chinese Academy of Medical Sciences and Peking Union Medical College according to guidelines of the declaration of Helsinki (Ethics number: KT2014005-EC-1).

2.2. Nutrition evaluation

Nutrition-related indicators were analyzed. Body mass index (BMI) = weight (kg)/height (m)^2; serum total protein (TP) was determined by the biuret assay; serum albumin (Alb) was determined by the bromocresol green method; FA, $VitB_{12}$ and SF were measured by radioimmunoassay; serum iron (SI) and unsaturated iron binding capacity (UIBC) were determined by the immunoturbidimetric method; and transferrin saturation (TS) was calculated as TS = (SI/SI + UIBC) 100%.

2.3. Statistical analysis

The SPSS 20.0 software was employed for statistical analysis. Normally distributed data were expressed as the mean ± standard deviation (mean ± SD), and the differences were compared using the t-test and analysis of variance. Non-normally distributed data were expressed as median with range, the differences were compared using the non-parametric Mann–Whitney U test, and the proportions between two or more groups were compared using the χ^2 test, where $p < 0.05$ indicated statistically significant.

3. Results

3.1. Characteristics of patients

As shown in Table 1, the median age of the patients was 21 (2–85) years, and the median BMI was 20.7 (12–32.9). This cohort of patients included 374 adult (60.1%), 345 male (55.5%), 430 SAA patients (69.1%) and 327 patients from the rural areas (52.6%). According to the laboratory indicator of Hb, the patients were divided into the following four groups: 0–30 g/L group, 30–60 g/L group, 60–90 g/L group and ≥90 g/L group; the proportions for each group were 0.3%, 23.2%, 57.2% and 19.3%, respectively.

Table 1
Characteristics of AA patients.

Characteristics	Values
Total number of patients	622
Median age (year)	21 (2–85)
Median BMI (kg/m^2)	20.7 (12–32.9)
Age; n (%)	
Adults	374 (60.1)
Children	248 (39.9)
Gender; n (%)	
Male	345 (55.5)
Female	277 (44.5)
Diagnosis; n (%)	
SAA	430 (69.1)
NSAA	192 (30.9)
Region; n (%)	
Urban	295 (47.4)
Rural	327 (52.6)
Hb grade, g/L; n (%)	
0 ~ 30	2 (0.3)
30 ~ 60	144 (23.2)
60 ~ 90	356 (57.2)
>90	120 (19.3)

Abbreviations: SAA, severe aplastic anemia; NSAA, non-severe aplastic anemia; Hb, hemoglobin.

3.2. Analysis of the nutrition indicators of AA patients

We analyzed the nutrition-related indicators of AA patients, including BMI, protein metabolism indicators (TP and Alb), vitamin metabolism indicators (FA and VitB12) and metabolism indicators of the trace element iron (SF, SI, UIBC, and TS).

3.2.1. BMI

BMI is an anthropometric indicator. When comparing BMI values among the groups in this study, the difference of BMI was statistically significant between SAA and NSAA patients ($p < 0.05$), with SAA patients having lower BMI values, whereas the differences between other groups were not statistically significant ($p > 0.05$).

3.2.2. Protein metabolism indicators

TP: The difference of TP among groups with different Hb grades exhibited statistical significance, p values between 30–60 g/L and 60–90 g/L groups, and between 30–60 g/L and ≥90 g/L groups were <0.05 and <0.01 respectively, and lower Hb values caused lower values of TP (Fig. 1). Conversely, the differences of TP were not statistically significant among groups with different genders, ages, regions and disease diagnoses (all $p > 0.05$).

Alb: The difference of serum Alb was statistically significant between SAA and NSAA groups ($p < 0.01$), with lower Alb values in SAA group. Among groups with different Hb grades, the differences between ≥90 g/L and 30–60 g/L groups, and between ≥90 g/L and 60–90 g/L groups were statistically significant ($p < 0.01$; $p < 0.05$), and lower hemoglobin values were associated with lower Alb values (Fig. 1). The differences among groups with different genders, ages, and regions were not statistically significant (all $p > 0.05$).

3.2.3. Vitamin metabolism indicators

FA: Differences between groups with different genders and regions were observed, FA values in male were lower than of female ($p < 0.01$), and FA values in patients from rural areas were lower than of patients from urban areas ($p < 0.01$). Differences among groups with different ages, diagnoses and Hb grades were not statistically significant (all $p > 0.05$) (Fig. 2).

VitB12: $VitB_{12}$ values in patients from rural areas were lower than of ones from urban areas ($p < 0.01$), and the differences among the remaining groups were not statistically significant (all $p > 0.05$) (Fig. 2).

3.2.4. Iron metabolism indicators

SF: As shown in Fig. 3, male SF values were higher than female, adults SF values were higher than children, and SAA patients' SF values were higher than NSAA ($p < 0.01$). In terms of Hb grades, the differences between ≥90 g/L and 30–60 g/L groups, and between ≥90 g/L and 60–90 g/L groups were statistically significant ($p < 0.01$). Conversely, the differences of SF values were not statistically significant among groups from different regions ($p > 0.05$).

SI: With regard to SI level, SI level in SAA group was higher than in NSAA group ($p < 0.01$). In terms of different Hb grades, the differences between ≥90 g/L and 30–60 g/L groups, and between ≥90 g/L and 60–90 g/L groups were statistically significant ($p < 0.01$; <0.05). No statistically significant differences were observed among groups with different ages, genders and regions (all $p > 0.05$).

UIBC: UIBC values in adults were lower than the ones in children ($p < 0.05$); its values in SAA patients were lower than those in NSAA ($p < 0.01$); also its values in 30–60 g/L group were lower than those in ≥90 g/L group ($p < 0.01$). No statistically significant differences were observed among the remaining groups.

TS: TS value in SAA group was significantly higher than in NSAA group ($p < 0.01$); with regard to Hb grades, the differences between ≥90 g/L and 30–60 g/L groups, and between ≥90 g/L and 60–90 g/L groups were statistically significant ($p < 0.01$). No statistically significant differences of TS values were observed in the remaining comparisons ($p > 0.05$).