Original Article

Malnutrition in hospitalized people living with HIV/AIDS: evidence from a cross-sectional study from Chengdu, China

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Objectives: Nutrition support has long been ignored in China's HIV/AIDS treatment and care. The objectives of this project were to evaluate the prevalence of malnutrition among Chengdu urban HIV positive patients, and to provide evidence for further nutritional intervention. Materials and Methods: HIV-infected adults admitted to an infectious diseases inpatient unit were eligible for this study. Nutritional status was evaluated using Subject Global Assessment (SGA), Malnutrition Universal Screening Tool (MUST), body mass index (BMI), food frequency questionnaire and dietary records. Results: 94 hospitalized HIV positive patients were enrolled from April 2009 to May 2010. The median CD4 T cell count was 44.0/mm^3. The prevalence of malnutrition is measured by three tools and ranged from 37.2% (by BMI) to 77.2% (by SGA class B/C or MUST scores≥2). Chi-square test showed significant relationship between opportunistic infections and MUST score (OR=5.67, $p<0.005$, 95% CI=1.96-16.4). Of patients, 59.6% had insufficient total energy intake; while 54.3% had insufficient protein intake. Conclusions: Malnutrition is highly prevalent among Chengdu urban HIV/AIDS patients who underwent inpatient treatment. Calorie and protein deficiency should be given more attention in HIV/AIDS care programs. Nutrition evaluation and support should be considered an integral parts of national and community HIV/AIDS treatment and care guidelines.

Key Words: HIV/AIDS, malnutrition, nutrition screening tool, hospitalized, China

INTRODUCTION

There are interactions between nutrition and HIV/AIDS. Macronutrient and micronutrient deficiencies in patients with HIV/AIDS are the result of a combination of the direct effect of HIV, opportunistic infections, reduced dietary intake, malabsorption and increased energy expenditure. The malnourished HIV patient is at a higher risk of developing opportunistic infections and AIDS-related illnesses. Evidence indicates that even relatively small losses in weight (5%) are associated with decreased survival rate.[1]

Recognizing the impact of nutrition on the progress of HIV/AIDS, the WHO has advocated that nutritional support should be integrated into national HIV/AIDS strategies in Resolution WHA57.14.[2] Although more and more countries have initiated national programs and strategies on adopting nutrition support as a component of compre-

hensive HIV treatment and care, China has not yet done so.

There has been a surge of new HIV diagnoses in China which appears to have affected those with the lowest income, which is also a risk factor for malnutrition. Since most new infections are diagnosed during the late stage of AIDS, malnutrition is most likely contributing to increased mortality. There is a paucity of data investigating nutritional status in HIV infected patients in China. Research

to date includes dietary investigation for HIV positive residents in rural areas, but did not include nutritional screening or assessment on hospitalized HIV/AIDS patients' nutritional status.[3,4]

To determine the prevalence of malnutrition in hospitalized HIV/AIDS patients, we conducted a cross-sectional survey in an urban centre (Chengdu City) in western China.

MATERIALS AND METHODS

We recruited patients from a local public HIV/AIDS treatment hospital. A consecutive series of patients confirmed to be HIV-positive and in need of hospitalized treatment were recruited. The inclusion criteria were: 1) HIV positive diagnosis was confirmed; 2) In need of hospitalized treatment for longer than 3 days; 3) Ages 18 to 90. Patients who suffered from cognitive impairment or were pregnant were excluded. The study was approved by the Institutional Review Boards of Sichuan Provincial People's Hospital and Peking Union Medical College Hospital. The Ethics Committee of Chengdu Transmitted Disease Hospital also approved this research. Informed consent was obtained from every participant at enrollment and patient confidentiality was ensured. We used a standard questionnaire that included three nutrition evaluation tools: 1) body mass index (BMI); and 2) malnutrition universal screening tool (MUST) was used as a nutritional screening tool; and 3) subjective global assessment (SGA) was used to assess the nutritional status of each participant.[5]

We used the BMI cut-off points criteria established by the Chinese Obese Workgroup (<18.5 kg/m^2 represents malnutrition, ≥24 kg/m^2 overweight and, and ≥28 kg/m^2 obese). MUST scores ≥2 indicated a high risk of malnutrition. Patients were assessed to be moderately (B) or severely (C) malnourished using the SGA.[1] These three survey tools have been used to assess malnutrition in the patients.

Dietary patterns were investigated using three methods: a 24-hour food recall,[6,7] and a food frequency questionnaire administered by a trained dietitian who followed a standardized procedure, and a 3-day food record diary. Patients or their family were instructed on how to keep a 24-hour food record and were given a food scale and a ruler to estimate portion size. Calorie, protein and other nutrients were calculated using software based on China's food composition (Keto Diet Calculator, Physician Pro V 2.0, Fresenius-Kabi).[8]

Data were described as mean±standard deviation (SD) or as medians and inter quartile ranges (IQR) in the case of a skewed distribution. Differences between groups were assessed with the Student's t-test or Mann-Whitney U test for data presented as means or medians, respectively. Differences in counts or percentages was evaluated with the chi-square test. Differences were considered significant for a two-tailed *p*-value <0.05. The odd ratio will be used to describe the strength of association or non-independence between two binary data values, while the Youden Index and will be considered as an indicator of the performance of the diagnostic tool. Student's t-test or Mann-Whitney U test, chi-square test and Youden Index

will be performed using the SPSS version 15 for Windows (SPSS Inc, Chicago, IL, USA).

RESULTS

One hundred patients meet all inclusion criteria from April 2009 to May 2010. Six eligible patients declined to participate in the study, and ninety-four patients were enrolled in the study. Of these patients 91.5% (86/94) were newly diagnosed and initiated anti-retroviral treatment (ARV) during this hospital admission. The demographic characteristics of patients are listed in Table 1. History of HIV/AIDS diagnosis and biochemistry characteristics is listed in Table 2.

Demographic characteristics of the study population is presented in table 1 and table 2 lists the HIV/AIDS characteristics and results of the biochemistry test after admission.

Nutritional evaluation found that the prevalence of malnutrition ranged from 37.2% (using BMI as a measure) to 55.3% (using SGA B&C grade), and 77.2% (using MUST≥2).

In terms of opportunistic infections (OIs, the definition of OIs is according to USCDC),[9] malnutrition was much more general in this patient group (MUST score≥2, *p*<0.001). By using Spearman correlation analysis, the

Table 1. Characteristics of the study population

	n (%)
Gender	
Female	13 (13.8)
Male	81 (86.2)
Age, yrs	
18-25	9 (9.6)
26-39	38 (40.4)
40-59	37 (39.4)
≥60	10 (10.6)
Unemployed	53
Urban	94
Weight, kg (mean±SD)	53.8±9.7
Weight loss prior to admission, %	
<5	42.9
5-10	18.7
>10	38.4

Table 2. HIV/AIDS characteristics and biochemistry results (at admission)

Characteristics	Mean ± SD or (Median, IQR)
Duration of HIV diagnosis, months	(1, 1-3)
CD4 T lymphocyte, cells/mm^3	(44, 18-137)
Total lymphocyte	(0.85, 0.60-1.10)
Triglycerides, mmol/L	1.67±0.96
Total cholesterol, mmol/L	3.77±1.36
CD4 T cell count (%)	
>350	4.26
201-350	6.38
100-200	12.6
<100	59.6
Serum albumin, g/L (%)	
≥35.0	47.9
<35.0	52.1

Table 3. BMI, SGA and MUST

Evaluation Method	All patients	Patients with OIs	p value
BMI (<18.5)	37.2%	39.7%	>0.05
SGA (B or C grade)	55.3%	57.1%	>0.05
SGA (Grade C)	21.3%	31.8%	>0.05
MUST (score≥2)	77.2%	82.5%	<0.001

result showed that the MUST score had a correlation to OIs (r=0.404, p<0.001, Table 4). Nutritionally at-risk is defined by MUST score ≥2. The chi-square test showed a significant correlation of MUST score ≥2 to opportunistic infections (OR=5.67, p=0.001, 95%CI=1.96-16.4, Table 5). There was also a significant correlation of BMI >20.0 negatively associated with opportunistic infection events at admission (OR=0.287, 95%CI=0.102-0.805, p =0.015, Table 5).We used Youden Indext to evaluate the prediction ability of BMI, SGA, and MUST to OIs and CD4 T cell Count. Results showed that the MUST had the highest Youden Index score on predict OIs (Youden Index=0.4, Table 6).

The Youden Index of BMI, SGA and MUST with OIs, CD4 T cell Count Opportunistic infections (OIs) were the predominant reasons for admission of patients (67.0%). For patients suffering from OIs, malnutrition ranged from 39.7% to 61.7% by different screening tools. The categories of OIs are presented in Figure 1.

Energy and protein intake
Compared to the average dietary intake of Chinese resi-

dents,[10] 83.8% of the male patients and 84.6% of the female patients consumed less than average calories. The details of calorie and protein intake are listed on Table 7. The Dietary Reference Intakes (DRIs) by Chinese Nutrition Society also were considered. To this end, inadequate energy intake was also prevalent in this group of patients (from 75% to 100%, per age/gender group, Table 8).

Dietary habit and life style
Of the patients, 89.4% had 3 regular meals daily; 57.4% ate snacks; and 44.7% of the patients smoked while 22.3% drank alcohol (>3 times per week). Around 40% of them took nutritional supplements. More than 40% of them consume less than 100 grams of meat per day. More details of dietary habit and life style are listed in Table 9.

DISCUSSION
To the best of our knowledge, there is no study on the prevalence of malnutrition in China's hospitalized HIV/AIDS patients to date. Based on SGA or MUST, malnutrition occurs in more than 50% of the patient population that we studied. It indicates that malnutrition, as a co-morbidity, may be epidemic in hospitalized metropolitan HIV/AIDS patients in China.

The result of this study demonstrates that inadequate food intake is common in HIV/AIDS patients. Eighty percent of them are deficient in energy and/or protein. In this group of patient, OIs related GI symptoms and stresswere the main reasons associated to inadequate food intake.[11] There is growing evidence demonstrating that providing appropriate nutritional intervention to increase

**Table 4.** Pearson correlation coefficients of BMI, SGA, MUST with OIs and CD4 T cell Count

Evaluation method	Correlation with OIs (p-value)	Correlation with CD4<200 (p-value)	Correlation with CD4<350 (p-value)
BMI	0.207 (0.640)	-0.027 (0.819)	-0.055 (>0.05)
SGA			
Grade B&C	0.182 (0.950)	-0.207 (0.690)	-0.032 (>0.05)
MUST (score≥2)	0.404 (<0.001)	-0.047 (0.689)	-0.023 (>0.05)

Table 5. The odd ratio (OR) of SGA, BMI and MUST to OIs

		OR	95% confidence interval	p-value
SGA	Grade A	0.429	0.157-1.17	>0.05
	Grade B	2.237	0.732-6.84	>0.05
	Grade C	1.340	0.337-5.33	>0.05
BMI	<18.5	2.961	0.896-9.78	>0.05
	18.5-20.0	2.115	0.430-10.4	>0.05
	>20.0	0.287	0.102-0.805	<0.05
MUST		5.673	1.96-16.4	<0.005

Table 6. The Youden Index of BMI，SGA and MUST with OIs，CD4 T cell Count

	OIs			CD4 200 cut-off point			CD4 350 cut-off point		
	Sensitivity	Specificity	Youden Index	Sensitivity	Specificity	Youden Index	Sensitivity	Specificity	Youden Index
BMI	0.86	0.33	0.19	0.38	0.58	-0.04	0.38	0.5	-0.12
SGA	0.57	0.64	0.21	0.49	0.23	-0.28	0.53	0.4	-0.07
MUST	0.85	0.55	0.4	0.78	0.17	0.05	0.79	0.25	0.04
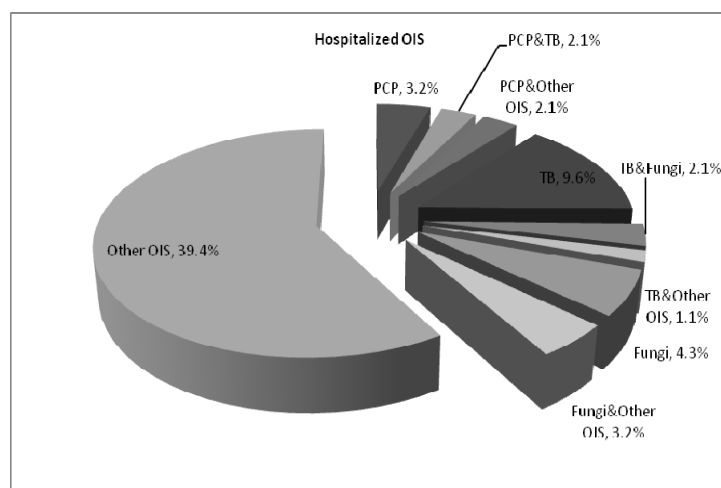
Figure 1. Hospitalized opportunistic infections

Table 7. Daily calorie and protein intakes

	HIV+ men	HIV+ women	Average Chinese dietary intake
Energy intake, kcal/d [Med (IQR)]	1406 (1042-2013)	1188 (811-1666)	<2134 kcal/d per reference man
Protein, g/d	54.6 (34.3-75.5)	39.9 (23.6-59.0)	<69 g/d per reference man
% with <average calorie intake	83.8	84.6	
% with <average protein intake	67.5	76.9	

Table 8. Daily calorie and protein intakes compare with DRIs

Age	Sex	Average of daily energy intake, kcal	<DRI of energy	Average of daily protein intake, g	<DRI of protein	DRI of energy, kcal	DRI of protein, g
18-49	Male	1572	86.7% (52/60)	43.6	71.7% (43/60)	2396	75
	Female	1365	75% (9/12)	42.7	75% (9/12)	2102	65
50-59	Male	1834	90% (9/10)	86.5	60% (6/10)	2298	75
	Female	750	100% (1/1)	14.9	100% (1/1)	1911	65
60-69	Male	1106	75% (6/8)	33.3	100% (8/8)	1897	75
	Female					1789	65
≥70	Male	1009	100% (2/2)	39.0	100% (2/2)	1897	75
	Female					1696	65

Table 9. Dietary habits and lifestyle factors

Dietary and lifestyle factors	%
3 regular meals daily	
No	10.6
Yes	89.4
Snacks	
No	42.6
Yes	57.4
Food habits	
None special	42.6
Vegetarian diet	28.7
Drank alcohol (>3 times/week)	
No	76.6
Yes	22.3
Current smoker	
No	55.3
Yes	44.7
Used nutritional supplements	
None	60.6
Vitamins	12.8
Immunity enhancer	6.4
Protein	20.2

calorie, protein and micronutrient in malnourished HIV/AIDS patients could improve outcomes and increase the efficacy of HAART.[12-15]

Unfortunately, health providers in China are still unaware of the fact that many hospitalized HIV/AIDS patients are malnourished. Medical nutrition therapy is not included in the national HIV/AIDS treatment handbook,[16] and most care programs for HIV/AIDSAIDS patient do not include nutritional service. Only one guideline from the Chinese Society for Parenteral and Enteral Nutrition (CSPEN) included nutritional intervention for AIDS patients.[8] The target users of CSPEN guidelines are those who work in the Department of Clinical Nutrition, and most of them are working at large, comprehensive hospitals in metropolitans (level 3 hospitals in China). The majority of facilities in China that admit severe HIV/AIDS patients are local, smaller hospitals (level 2 or 1 hospitals) where there is usually no nutrition service provided.[17] In all of China, there are only 2000 registered dietitians working in hospitals and clinical nutrition is not accredited as a clinical specialty at Ministry of Health of China until the end of 2009.[18]

We used two tools (MUST as a screening tool and, SGA as an assessment tool) and found that a high nutritional risk defined by MUST was significantly associated

with the presence of OIs. There was a statistically significant correlation of MUST score ≥ 2 to opportunistic infections (OR=5.67, 95%CI=1.96-16.4, p=0.001). MUST should be recommended as a nutritional screening tool for hospitalized HIV/AIDS patients. The results of this study show that compared with comprehensive tools SGA and MUST, single parameter BMI<18.5 grossly underestimated the rate of malnutrition. BMI roughly reflects body mass and does not measure nutritional intake history, metabolic abnormality or disease related nutritional impairment. With MUST, food intake, disease specific metabolic changes, along with weight loss are considered (BMI is a component of MUST). Therefore we conclude that BMI<18.5 alone may underestimate malnutrition in hospitalized HIV/AIDS patients. We also found that BMI >20.0 kg/m^2 negatively associated with OIs at admission. It may indicate that 20.0 should be considered as nutritional risk cut-off point for hospitalized HIV/AIDS patients.

A nutrition-screening tool is the quickest method to identify patients at risk of malnutrition. It is therefore essential for creating a pathway for establishing appropriate nutrition assessment and intervention in both clinical and community settings. MUST is a short scoring system described in detail in 2003. It calculates a patient's nutritional risk by using BMI, weight loss, and the effect of disease on nutritional intake. MUST is the recommended tool by the European Society for Clinical Nutrition and Metabolism (ESEN), for screening nutritional status in the community in the UK. SGA was first described in 1982 as a formalization of the process used by skilled clinicians to diagnosis PEM (protein-energy malnutrition). The model involves five elements (dietary intake, weight change, gastrointestinal symptoms, functional capacity, and identification of the primary disease and any associated metabolic stress) and a targeted physical examination. Patients are assessed as well nourished (A), moderately malnourished (B), or severely malnourished (PEM) (C). A score of B or C indicates that a patient should be referred to a nutrition professional such as a registered dietitian for full assessment and intervention.

More than 90% of the patients in this study are "late testers of HIV" (patients are defined as 'late testers' if they present either symptoms of clinical AIDS or CD4 cell count of less than 200/mm^3 during this period). It is consistent with the report by Li TS et al[19] and much higher than reports from developed countries.[20, 21] Zhang FJ et al reported results from nationwide ARV programs in China and found that median baseline CD4 counts were 118 overall for patients who initiated ARVs.[22] The baseline median CD4 counts in this study were much lower than this national average. It reflects a mixed scenario in China's ARV practice. Creen P et al has demonstrated that resting energy expenditure (REE) is elevated in asymptomatic, un-treated HIV-infection patient and will increase with AIDS symptoms.[23] Higher viral load, decreasing of CD4 count are both found to be associate with elevated REE.[24,25] To this end, the impact of the epidemic of severe malnutrition on "late tester" HIV/ AIDS patient is understandable.

Along with malnutrition, smoking is another important problem that may impede the long-term quality of life in this group of patients. Nearly 45% of our cohorts were current smokers. It is slightly lower than the estimated smoking prevalence in Chinese adult men (52.7%, 2010 by China CDC)[26] and similar to an estimated prevalence in people living with HIV/AIDS(PLWHA) in the US.[27] According to the D: A: D (Data Collection on Adverse events of Anti-HIV Drugs) study, smoking is the strongest independent risk factor related to chronic vascular disease and heart disease in PLWHA.[28] In addition, smoking has been associated with an increase in opportunistic infections as it suppresses host defenses and alters the respiratory environment, thereby contributing to bacterial pneumonia.[29]

The results of this study are based on a relative small, urban inpatient survey. Considering that different regions of China vary hugely in factors such as socio-economy and dietary habits, more large scale and multi-center studies are required for further confirmation of our findings. In order to evaluate the impact of malnutrition and comprehensive nutritional intervention on the long-term outcome of this group of patients, the authors have initiated a longitudinal study.

In summary, this study reveals that malnutrition is highly prevalent and a major challenge for urban HIV/ AIDS patients undergoing inpatient care. Energy and protein deficiencies should be given more attention in HIV/ AIDS care programs. We feel that in order to reduce the prevalence of malnutrition, all patients with HIV infection should be given a nutrition screening. Those at a high degree of nutritional risk should then have a nutritional assessment and a subsequent nutrition care plan including estimated energy and protein requirements, a prescription of feeding mode (food, supplements, tube feeding or parenteral nutrition), and a plan for monitoring. At the present, increasing awareness of malnutrition by physicians and nurses, providing sensitive and easy to use nutrition evaluation tool are essential for clinical care. This should be set up in all AIDS Departments to solve the malnutrition and chronic wasting problem.

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Original Article

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住院艾滋病患者中的营养不良：基于中国成都一项横断面研究的证据

目的：中国的艾滋病治疗与关怀项目中长期缺乏对营养支持的关注，本研究旨在评估成都市区 HIV 阳性患者的营养不良流行率，并为进一步营养干预提供依据。对象与方法：研究对象为成都市传染病医院的住院 HIV 感染者/艾滋病患者。采用主观全面评定法（SGA）、营养不良筛查工具（MUST）、体质指数（BMI）、食物频度问卷及膳食回顾法进行营养评估。结果：自 2009 年 4 月-2010 年 5 月，纳入 94 例住院 HIV 阳性患者。本组患者 CD4 T 细胞计数中位数为 44.0/mm^3。采用三种方法进行营养筛查后发现，营养不良患病率从 37.2%(BMI)到 77.2（SGA B/C 级或 MUST 评分≥2）。卡方检验发现机会性感染与 MUST 评分显著相关（(OR=5.67, p<0.005, 95% CI=1.96-16.4)。59.6%的患者存在能量摄入不足；54.3%的患者存在蛋白质摄入不足。结论：成都市住院 HIV/AIDS 患者中普遍存在营养不良。艾滋病关怀项目应该对能量和蛋白质摄入不足问题加以关注。应当将营养评估与营养支持内容纳入国家及社区艾滋病治疗和关怀指南。

关键词：艾滋病、营养不良、营养筛查工具、住院患者 、中国