Original Article

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Nutritional Status and Outcomes of Thai Elderly Patients Hospitalized with Heart Failure

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Abstract:

Objective: To assess the prevalence of undernourishment, nutritional status, and clinical outcomes among patients with heart failure admitted to Bangkok Heart Hospital using the Mini Nutritional Assessment-Short Form (MNA-SF).

Material and Methods: This cross-sectional retrospective study enrolled 361 patients hospitalized with heart failure in Bangkok Heart Hospital between January 2019 and December 2022. The MNA-SF was used as a screening scale to assess nutritional status. Clinical outcomes included length of stay, hospital-acquired infections, in-hospital mortality, unscheduled 30-day hospital readmission, and all-cause mortality within 180 days post-discharge.

Results: The study included 239 hospitalized patients with a median age of 80 years (interquartile range, IQR: 72.0-80.0); among them, there were 128 men. Most patients experienced heart failure with preserved ejection fraction. The prevalence of undernutrition was 61.1%, with a median length of stay of 8 days (IQR: 5.0–15.0). The median length of stay of the well-nourished patients (6 days, IQR: 4.0-11.5) was significantly lower than that of the undernourished patients (9 days, IQR: 6.0–15.0; p-value<0.01). In addition, the hospital-acquired infection rate was significantly higher in undernourished patients (43.8% and 16.1%; p-value<0.01). The unscheduled 30-day hospital readmission rate and mortality rate within 6 months post-discharge were significantly higher among undernourished patients than among well-nourished patients.

Conclusion: Undernutrition resulted in worse clinical outcomes, including prolonged hospital stay, hospital-acquired infections, unscheduled 30-day readmission, and a high mortality rate within 6 months post-discharge.

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Introduction

Nutritional status is associated with medical costs and clinical outcomes, including length of hospital stay, hospital–acquired infections, in–hospital mortality, and unscheduled 30–day readmission[1,2]. A Chinese study found that the overall prevalence of malnutrition risk among elderly patients hospitalized because of heart failure ranged from 23.7% to 58.6%[3]. Malnourishment, in particular, has a high incidence among elderly patients with heart failure[4]. Furthermore, heart failure can lead to malnutrition by altering appetite, food intake, and nutrient malabsorption[5].

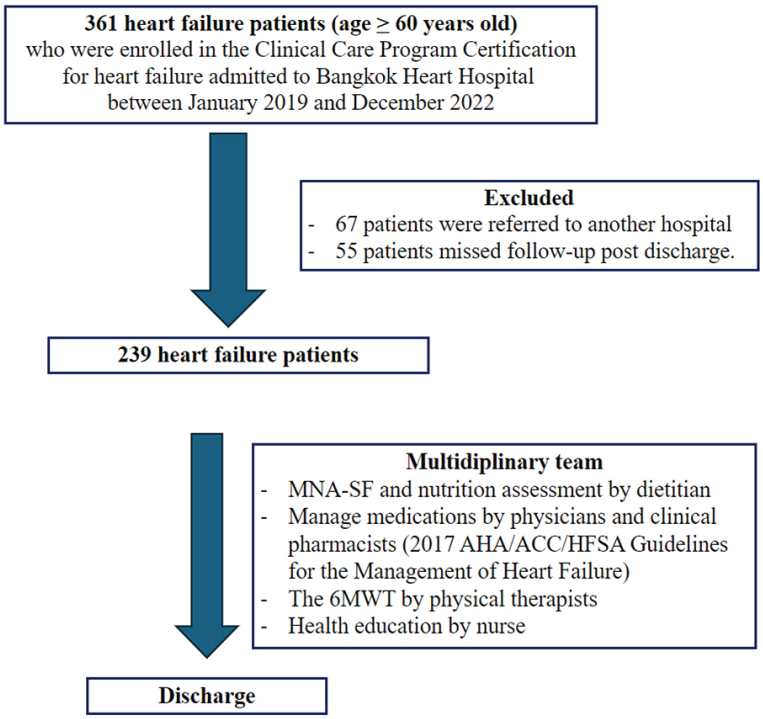
Nutrition screening or nutritional risk assessment upon hospital admission effectively identifies patients who may be experiencing malnutrition. There are 6 nutritional screening tools and assessments for patients with heart failure, including the Subjective Global Assessment (SGA), Prognostic Nutritional Index (PNI), Geriatric Nutritional Risk Index (GNRI), Controlling Nutritional Status Score (CONUT), Nutritional Risk Index (NRI), and Mini Nutritional Assessment–Short Form (MNA–SF). The study concluded that the MNA–SF was the most recommended tool for the nutritional screening of patients with heart failure[6]. For older adults, the European Society for Parenteral and Enteral Nutrition recommended the use of the MNA in either the full or short form[7]. Previous studies have indicated that the MNA–SF is a valid instrument with good specificity and sensitivity for diagnosing malnutrition, especially for the older population[8–10]. In patients with heart failure, the MNA–SF has a specificity of 99% and sensitivity of 69%, with the lowest misclassification rate for detected malnutrition compared with CONUT, GNRI, PNI, SGA, and Malnutrition Screening Tools (MUST)[6]. The recent systematic review and meta–analysis concluded that MNA–SF demonstrated the strongest association with prognosis for hospitalized heart failure patients, especially in older subjects when compared with the CONUT, GNRI, and PNI. Therefore, MNA–SF may be the most suitable choice for healthcare professionals to screen the nutritional risk of patients hospitalized with decompensated HF[11].

To our knowledge, no previous study has systematically addressed the predictive value of the MNA–SF in Thai patients with heart failure. This study aimed to assess the prevalence of undernourishment, nutritional status, and clinical outcomes among patients with heart failure admitted to Bangkok Heart Hospital using the MNA–SF.

Material and Methods

This cross–sectional retrospective study collected data from the electronic medical records of Thai elderly patients (age ≥60 years) who were enrolled in the Clinical Care Program Certification for heart failure and admitted to Bangkok Heart Hospital between January 2019 and December 2022. The study excluded patients who were referred to other hospitals, could not come back for follow–up appointments within 180 days post–discharge, had advanced cancer, or were receiving palliative care (Figure 1).

The echocardiogram's left ventricular ejection fraction was used as the basis for classifying heart failure. There are 3 types of heart failure: heart failure with reduced ejection fraction (HFrEF), mildly reduced ejection fraction (HFmEF), and preserved ejection fraction (HFpEF). The New York Heart Association (NYHA) classifies patients into 4 classes (I, II, III, and IV) based on the severity of their symptoms[12]. For patients with heart failure, physicians and clinical pharmacists should manage medications such as angiotensin–converting enzyme inhibitors (ACEI), angiotensin receptor blockers (ARBs), calcium channel blockers, and beta–blockers per the 2017 AHA/ACC/HFSA Guidelines for the Management of Heart Failure[13].



MNA-SF=mini nutritional assessment-short form, AHA/ACC/HFSA=American Heart Association/ American College of Cardiology/ Heart Failure Society of America, 6MWT=six-minute walk test

Figure 1 Study diagram

The 6-minute walk test (6MWT) to identify the patient's physical functional capacity was administered by physical therapists before discharge. This study was approved by the Institutional Review Board of Bangkok Hospital Headquarters (approval code BHQ-IRB 2023-01-03) and complied with the Declaration of Helsinki.

Nutritional status

The dietitian used the MNA-SF to assess patients' nutritional status. The MNA-SF comprises 6 questions that give a score of 0–14. A score of ≥12 indicates well-nourished, whereas a score of <12 indicates undernourished (in general, MNA-SF scores of <8 and 8–11 indicate malnutrition and risk of malnutrition).

Outcomes measurement

This study evaluated the prevalence of undernourished heart failure in patients admitted to the Bangkok Heart Hospital. Concerning clinical outcomes, we tracked hospital-acquired infections, length of hospital stay, in-hospital mortality, unscheduled 30-day hospital readmissions, and all-cause mortality within 180 days post-discharge. The diagnostic criteria for infection were that the blood, mucus, sputum, urine, or stool cultures from patients were positive and blood samples showed increased white blood cells, neutrophil, and/or lymphocyte counts and/or signs and symptoms of infection, e.g., fever, chill, sweat, diarrhea. The hospital discharge criteria were as follows:

- Patients were treated, and the causes of recurrent heart failure were determined.

- Before discharge, the patients' symptoms improved, and their vital signs remained stable for at least 24 hours.
- Patients did not receive intrafluid diuretics, vasodilators, or inotropes within 24 hours before discharge.

Patients with HFrEF started oral medications per the following standards: ACEIs, ARBs, angiotensin receptor blocker neprilysin inhibitor, and selective beta-blockers. The abovementioned medicines must be contraindicated.

Statistical analysis

The Kolmogorov–Smirnov test (KS test) was used to determine whether a sample came from an assumed continuous probability distribution. Categorical variables were expressed as percentages. Nonparametric data were presented as the median and interquartile range (IQR). The Mann–Whitney U test was used to evaluate whether there was a difference in the continuous variables between the 2 dependent groups. We used the chi-square test to compare the proportions of categorical variables. For statistical analyses, a confidence interval with p-values<0.01 and <0.05 was considered. The data were analyzed using IBM SPSS Statistics, Version 24.

Herein, the Yamane formula was used to estimate the infinite population proportion. Per Barbosa's study, malnutrition was 10.4% of hospitalized patients with heart failure in private hospitals[14]. The sample included 139 patients.

Results

This study enrolled 361 elderly patients hospitalized with heart failure, of which 67 were referred to another hospital, and 55 missed follow-up appointments post-discharge. Finally, 239 patients were included. There were 128 men (53.6%) with a median age of 80 years (IQR: 72.0–80.0). The median admission neutrophil/lymphocyte ratios and BMI on admission were 4.4 (IQR: 2.8–7.8), and 25.8 kg/m^2 (IQR 22.4–29.3), respectively. The median age, admission neutrophil/lymphocyte ratios, and BMI on admission were significantly different between the well-nourished patients and undernourished patients. The median admission neutrophil/lymphocyte ratios and age of the undernourished patients were 4.7 (3.0–8.8) and 82 years (IQR: 73.0–87.0), which were significantly higher than that of the well-nourished patients, 75 years (IQR: 71.0–82.0) and 3.7 (2.6–6.0), respectively. The median BMI on admission was 28.5 kg/m^2 (IQR: 25.4–31.4), significantly higher in well-nourished patients than in undernourished patients (24.5 kg/m^2, IQR: 21.7–28.1). Most patients had problems with water retention upon admission, with 69.0% exhibiting signs of edema.

Most patients had HFpEF (64.0%). According to the NYHA classification of heart failure, 204 patients (85.3%) had a worse clinical status upon admission in classes III and IV; the highest comorbidity was hypertension (Table 1).

Table 2 shows the comparison of outcomes between the well-nourished and undernourished patients using the MNA-SF. The median length of stay showed significant differences between the well-nourished (6.0 days, IQR: 4.0–11.5) and the undernourished (9.0 days, IQR: 6.0–15.0; p-value<0.01). The overall median length of stay was 8.0 days (IQR: 5.0–15.0). This study found that 106 patients, or 44.4% of patients, had a longer length of stay than the median (75 patients, or 51.4% in undernourished and 31 patients or 33.3% in well-nourished).

The 6MWT before discharge was a physical and functional performance measurement for assessing only 151 participants (5 patients died during admission, 15 were bedridden, and 68 required walking aids). The results showed that the well-nourished patients could walk significantly longer distances (180.0 m; IQR: 70.0–250.0) compared with the undernourished patients (76.0 m [IQR: 37.8–140.0]).

Table 1 General characteristics of patients upon admission (n=239)

Variables	Median (IQR), n (%)			p-value
	Total, n (%)	Well-nourished (n=93)	Undernourished (n=146)	
Age (years)	80 (72.0-80.0)	75[a] (70.5-82.0)[a]	82 (73.0-87.0)[b]	0.000
Neutrophil/Lymphocyte ratio	4.4 (2.8-7.8)	3.7 (2.6-6.0)[a]	4.7 (3.0-8.8)[b]	0.018
BMI on admission (kg/m^2)	25.8 (22.8-29.3)	28.5(25.4-31.4)[a]	24.5 (21.7-28.1)[b]	0.000
Male, n (%)	128 (53.6)	58 (62.4)	70 (47.9)	-
Female, n (%)	111 (46.4)	35 (37.6)	76 (52.1)	-
Sign of edema on admission, n (%)	165 (69.0)	68 (73.1)	97 (66.4)	-
Types of heart failure, n (%)				
HFrEF	70 (29.3)	23 (24.7)	47 (32.2)	-
HFmEF	16 (6.7)	7 (7.5)	9 (6.2)	-
HFpEF	153 (64.0)	63 (67.7)	90 (61.6)	-
Admission NYHA classification, n (%)				
Class I and II	35 (14.6)	16 (17.2)	19 (13.0)	-
Class III and IV	204 (85.3)	77 (82.8)	127 (87.0)	-
Co-mobidities, n (%)				
Atrial fibrillation	94 (39.3)	28 (30.1)	66 (45.2)	-
Cerebrovascular disease	49 (21.4)	13 (14.0)	36 (24.7)	-
Chronic kidney disease	98 (41.0)	31 (33.3)	67 (45.9)	-
Diabetes mellitus	136 (56.9)	56 (60.2)	80 (54.8)	-
Dyslipidemia	125 (52.3)	56 (60.2)	69 (47.3)	-
Hypertension	201 (84.1)	80 (86.0)	121 (82.9)	-
Ischemic heart disease	104 (43.5)	44 (44.1)	63 (43.2)	-

Data are presented as the median and interquartile range (IQR) or frequency (%), as appropriate.
HFrEF=heart failure with reduced ejection fraction, HFmEF=heart failure with mildly reduced ejection fraction, HFpEF=heart failure with preserved ejection fraction, NYHA=the New York Heart Association

Table 2 Comparison of the outcomes between well-nourished and undernourished patients using the Mini Nutritional Assessment-Short Form (n=239)

Outcomes	Nutritional status on admission by MNA-SF		p-value
	Well-nourished (n=93)	Undernourished (n=146)	
Length of stay (days)	6 (4.0-11.5)[a]	9(6.0-15.0)[b]	0.001
6MWT before discharge (meters), (n=151)	180 (70.0-250.0)[a] (n=71)	76 (37.8-140.0)[b] (n=80)	0.000

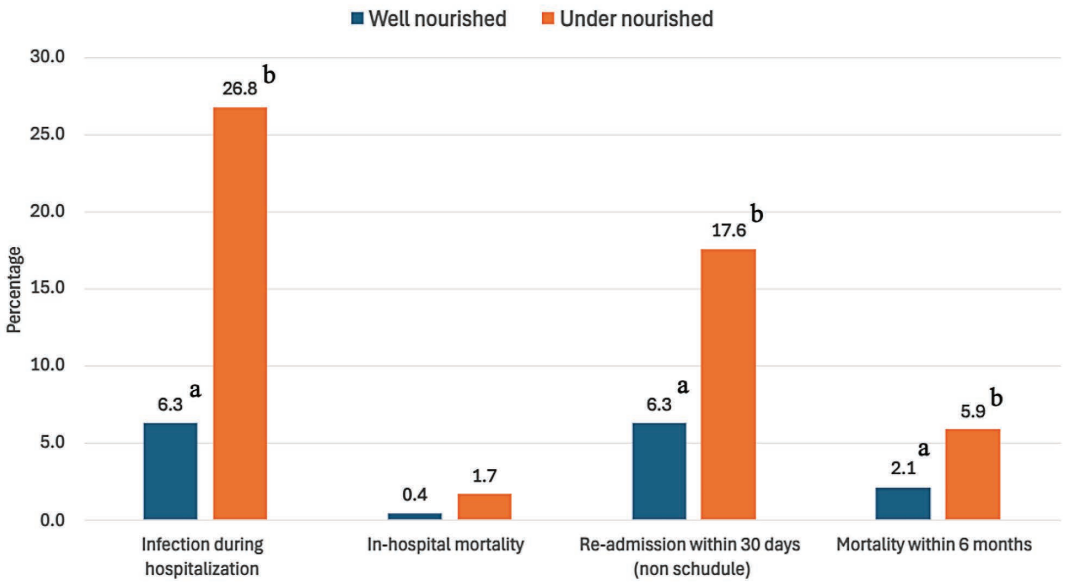
Data are presented as the median and interquartile range (IQR), *Different superscripts indicate significant differences (p-value<0.01), A Mann-Whitney test was performed (p-value<0.01).
6MWT=six-minute walk test

This study demonstrated that MNA-SF on admission independently predicted that infection during hospitalization, non-scheduled re-admission within 30 days, and 6-month mortality post-discharge were significantly higher in undernourished patients. Reportedly, in-hospital mortality among patients with heart failure tended to be higher in the undernourished patients, but not significantly (Figure 2).

Discussion

Herein, the overall MNA-SF undernourished and well-nourished statuses were 61.1% and 38.9%, respectively. A previous study explained the high prevalence of the undernourished, illustrating that the percentage of malnourishment varies according to age, comorbidities, socioeconomic status, and nutritional screening tools[15-16]. Another cross-sectional, multicenter study of Chinese geriatric inpatients (mean age 81.2±5.9 years) revealed differences in malnourishment detected using different screening tools.

The results showed that the prevalence of malnourishment, according to Nutrition Risk Screening 2002 (NRS 2002), was 40.9% and that of MNA was 58.6%[3]. The Empagliflozin Outcome Trial in Patients with Chronic Heart Failure with Preserved Ejection Fraction study revealed that the GNRI indicated malnutrition in 51.9% of Japanese patients hospitalized for HFpEF. The patient's average age was 77.0±12.0 years[17]. A study of 2,906 hospitalized patients aged ≥15 years at Somdech Phra Debaratana Medical Center, Ramathibodi Hospital in Bangkok, Thailand, between January 2016 and September 2016, found that 15.3% of patients were undernourished, according to the Nutrition Alert Form, and 84.7% were well-nourished. The mean age of the patients was 57.2±17.3 years. Furthermore, older individuals had a high prevalence



*Different superscripts indicate significant differences (p-value<0.01), Chi-square test was performed (p-value<0.01)

Figure 2 Comparison of the percentage of clinical outcomes according to the nutritional status of hospitalized patients with heart failure

of malnourishment[16]. The meta-analysis included 67 cross-sectional studies, of which 4 were prospective cohort studies on elderly people in Thailand between January 2020 and September 2020. Most of the 51 studies conducted in a community setting found a prevalence of malnourishment in the MNA and MNA-SF of 37.8% and 42.6%, respectively[4].

The highest comorbidity in patients hospitalized with heart failure in this study was hypertension, which was similar to a previous study that noted hypertension as the most common cardiovascular comorbidity. Prolonged hypertension promotes left ventricular hypertrophy, which eventually leads to heart failure[18]. Maeda et al. concluded that hypertension could lead to HFrEF and HFpEF[15]. Patients with hypertension predisposed to HFpEF might experience concentric changes because of pressure overload and inflammation. Conversely, concomitant cardiovascular disease can influence abnormal remodeling, leading to HFrEF[15].

BMI is a simple method for determining nutritional status. The median BMI on admission was 28.5 kg/m^2 (IQR: 25.4-31.4), significantly higher in well-nourished patients than in undernourished patients (24.5 kg/m^2, IQR: 21.7-28.1). However, most patients (69.0%) had problems with water retention upon admission. The Kyoto Congestive Heart Failure Registry is a multicenter cohort study that enrolled consecutive patients hospitalized for acute decompensated heart failure for the first time between October 2014 and March 2016 in 19 secondary and tertiary hospitals, including rural and urban, as well as large and small institutions across Japan. A total of 3,509 patients were discharged alive. A previous study found that a lower BMI was related to a higher risk of death post-discharge in patients with heart failure[19]. In a study from Vietnam, underweight patients showed a significantly higher incidence of all-cause mortality than normal-weight and overweight patients (p-value=0.0008)[20]. The 6MWT is a functional test that demonstrates the difference between well-nourished and undernourished elderly patients with chronic heart failure. The 6MWT of elderly patients also related to age, self-care ability, fall risk, nutrition, frailty, and depression[21].

This study demonstrated a significant correlation between undernourished, prolonged hospital stay, and increased infection during hospitalization, which is consistent with prior research on the impact of malnutrition on the immune system and the subsequent complications[22].

Malnourished patients usually have poor clinical outcomes, including high mortality. Zhang et al.'s study of 536 hospitalized Chinese geriatric patients aged ≥65 years demonstrated that patients who were undernourished, according to the MNA-SF, had a higher risk of mortality than patients with normal nutrition (Kaplan–Meier curve $\chi 2=28.999$, p-value<0.001)[23].

Previous meta-analyses have shown that malnutrition assessed using various nutrition screening tools was associated with a 1.9-fold high risk of all-cause mortality in patients with heart failure[2]. Appropriate nutritional interventions are important for improving the clinical outcomes in undernourished patients with heart failure. After 12 months of follow-up, the Program of Nutritional Intervention in Malnourished Patients Hospitalized for Heart Failure found a significant reduction in all-cause mortality and hospitalizations among patients with heart failure who received nutritional interventions[24]. The unscheduled 30-day hospital readmission rate was higher in undernourished patients than in well-nourished patients, which is consistent with other studies[25].

Study limitations

This was a retrospective single-center study conducted in a private hospital. Consequently, some patients were referred to another hospital and missed their follow-up after discharge due to financial causes.

Conclusion

This study revealed that approximately three-fifths of elderly patients with heart failure admitted to Bangkok Heart

Hospital were undernourished per MNA-SF. Furthermore, undernourishment prolonged the length of stay, increased hospital-acquired infections, unscheduled 30-day hospital readmission, and 6-month mortality post-discharge.

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Conflict of interest

All authors declare that they have no conflicts of interest.

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