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Original article

Influence of undernutrition at admission on clinical outcomes in patients with acute myocardial infarction

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ABSTRACT

Background: Although the effect of overweight or obesity on clinical outcomes in patients with acute myocardial infarction (MI) has been reported, the effect of undernutrition is not as well understood. Therefore, we investigated whether acute MI patients frequently present with undernutrition, and whether this influences poor clinical outcomes.

Methods and results: Using the Korea Acute Myocardial Infarction Registry database, we screened initial data on acute MI patients admitted within 48 h of symptom onset to a tertiary university hospital between November 1, 2011 and May 31, 2015. We then assessed nutritional status at admission, using the Geriatric Nutritional Risk Index (GNRI). Of a total of 2251 patients, there were 1585 (70.4%) men, and mean age was 65.0 ± 12.8 years. Based on GNRI score, undernutrition at admission was present in 409 (18.2%) patients. Multiple logistic regression analysis found undernutrition to be an independent factor influencing post-MI complications [odds ratio (OR), 2.13; 95% confidence interval (CI), 1.61–2.84; $p < 0.001$], after adjusting for age, sex, hypertension, diabetes, hyperlipidemia, previous stroke, smoking, diagnosis, number of involved vessel lesions, Killip class, atrial fibrillation, baseline blood pressure, hemoglobin, creatine kinase-MB, creatinine, performance of percutaneous coronary intervention, reperfusion time, recanalization, and use of antithrombotics. Undernutrition was also an important factor influencing in-hospital death (OR, 2.48; 95% CI, 1.55–3.95; $p < 0.001$), after adjusting for all potential factors by univariate analysis.

Conclusions: Nutritional status is a significant prognostic factor in clinical outcomes after MI during hospitalization. Therefore, nutritional assessment and intervention, especially for undernourished MI patients, should be considered.

Introduction

Undernutrition is a well-known prognostic factor of poor outcomes in medical [1–3], surgical [4–7], and community-dwelling [8,9] patients. In multiple studies, nutritional status at admission has been reported as an independent predictor of continued undernutrition after hospitalization [3], as well as poor clinical outcomes, such as complications [3,10] and mortality [6,11,12].

Myocardial infarction (MI) is caused by atherosclerotic plaque rupture or erosion in the coronary arteries, formed as a result of a chronic inflammatory response by white blood cells in the artery walls. In view of the malnutrition–inflammation–atherosclerosis (MIA) syndrome [1], malnutrition may be a proxy indicator of inflammation, and may be a risk factor or prognostic indicator for MI.

Therefore, unlike previous studies that focused on the effect of overweight or obesity on clinical outcomes in patients with acute MI [13–15], we sought to investigate the prevalence of undernutrition at admission and whether it influences clinical outcomes during hospitalization after MI.

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Materials and methods

Study population

This was a retrospective study performed to investigate the clinical effect of premorbid undernutrition in patients with acute MI. We enrolled patients who (1) were admitted within 48 h of symptom onset to the Cardiovascular Center of Chonnam National University Hospital, Gwangju, Korea, between November 1, 2011 and May 31, 2015; (2) were diagnosed with acute MI, including ST-elevation MI (STEMI) and non-STEMI; and (3) had nutritional assessment performed at admission.

The study population of initially screened patients was all registered in the Korea Acute Myocardial Infarction Registry (KAMIR) [16] for this study period. We included in the study only patients who had been assessed for baseline serum albumin and body weight (BW) as nutritional parameters, which were recorded in the electronic medical record (EMR).

In KAMIR, acute MI was diagnosed in patients who experienced a typical increase and decrease in biochemical markers of myocardial necrosis [e.g. creatine kinase (CK)-MB and troponin I and T], with at least one of the following: ischemic symptoms, electrocardiographic changes indicative of ischemia (e.g. ST-segment elevation or depression), and the development of pathologic Q waves on an electrocardiogram (ECG) [17].

Clinical variables and data collection

General characteristics (age, sex), nutritional status at admission, risk factors for vascular disease, disease-related characteristics, and various clinical outcomes were assessed. Risk factors for vascular disease included hypertension, diabetes mellitus,

Table 1
The comparison of general and clinical characteristics between nourished and undernourished patients at admission ($N = 2251$).

	Nourished ($n = 1842$)	Undernourished ($n = 409$)	p value
General characteristics and nutritional status			
Age, years	63.2 ± 12.5	72.9 ± 10.6	<0.001
Female	472 (25.6)	194 (47.4)	<0.001
BMI, kg/m^2	24.8 ± 3.1	20.3 ± 2.6	<0.001
Underweight (<18.5)	11 (0.6)	93 (22.7)	
Normal (≥18.5 and <25)	1048 (56.9)	298 (72.9)	
Overweight (≥25 and <30)	687 (37.3)	17 (4.2)	
Obesity (≥30)	96 (5.2)	1 (0.2)	
Baseline albumin, g/L	39.5 ± 3.6	31.9 ± 4.0	<0.001
Baseline hemoglobin, g/dL	14.1 ± 4.6	11.4 ± 2.2	<0.001
Risk factors			
Hypertension	941 (51.1)	246 (60.1)	0.001
Diabetes	526 (28.6)	141 (34.5)	0.018
Hyperlipidemia	142 (7.7)	15 (3.7)	0.004
Previous MI	158 (8.6)	46 (11.2)	0.089
Previous angina	165 (9.0)	49 (12.0)	0.059
Heart failure	31 (1.7)	11 (2.7)	0.174
Previous stroke	120 (6.5)	42 (10.3)	0.008
Smoking	1106 (60.0)	188 (46.0)	<0.001
Family history	110 (6.0)	10 (2.4)	0.004
Disease-related characteristics			
Diagnosis – STEMI	815 (44.2)	160 (39.1)	0.058
Number of involved vessel lesions	1.4 ± 0.9	1.6 ± 1.1	0.001
0	167 (9.1)	38 (9.5)	
1	1016 (55.6)	183 (45.9)	
2	415 (22.7)	103 (25.8)	
3	154 (8.4)	43 (10.8)	
4	64 (3.5)	29 (7.3)	
5	11 (0.6)	3 (0.8)	
Killip class in the ER	1.3 ± 0.8	1.9 ± 1.1	<0.001
I	1489 (80.8)	220 (53.8)	
II	184 (10.0)	60 (14.7)	
III	94 (5.1)	69 (16.9)	
IV	75 (4.1)	60 (14.7)	
A-fib on ER ECG	106 (5.8)	43 (10.5)	<0.001
Baseline SBP, mmHg	124.2 ± 26.8	112.2 ± 34.3	<0.001
Baseline DBP, mmHg	77.6 ± 17.4	69.7 ± 23.5	<0.001
Baseline heart rate, beats/min	78.6 ± 17.9	83.5 ± 25.5	<0.001
Baseline creatine kinase-MB, ng/mL	100.8 ± 127.7	81.7 ± 117.2	0.006
Baseline serum creatinine, mg/dL	1.0 ± 0.9	1.4 ± 1.4	<0.001
Performance of PCI	1574 (85.5)	320 (78.2)	<0.001
Onset-to-ER arrival time, h, $n = 1894$	3.5 (1.8–8.1)	4.0 (1.9–10.1)	0.081
ER-to-ballooning time, h, $n = 1894$	1.8 (1.0–7.0)	1.9 (1.0–6.0)	0.441
Post-PCI TIMI flow, $n = 1894$	3.0 ± 0.2	3.0 ± 0.3	0.472
0	3 (0.2)	2 (0.6)	
1	6 (0.4)	1 (0.3)	
2	36 (2.3)	7 (2.2)	
3	1529 (97.1)	309 (96.9)	
Antiplatelet	1833 (99.5)	406 (99.3)	0.466
Anticoagulation	63 (3.4)	22 (5.4)	0.060

Data are presented as number (percentage), mean ± standard deviation, or median (interquartile range), and p values were calculated by chi-square test, Fisher's exact test, independent t-test, and Mann–Whitney U test, where appropriate.
BMI, body mass index; MI, myocardial infarction; STEMI, ST-elevation myocardial infarction; A-fib, atrial fibrillation; ER, emergency room; ECG, electrocardiography; SBP, systolic blood pressure; DBP, diastolic blood pressure; PCI, percutaneous coronary intervention; TIMI, Thrombolysis In Myocardial Infarction.