An Observational Cohort Study Investigating Risk of Malnutrition Using the Malnutrition Universal Screening Tool in Patients with Stroke

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Background: Malnutrition in patients hospitalized with a stroke have been assessed using different nutritional screening methods but there is a paucity of data linking risk of malnutrition to clinical outcomes using a validated tool. *Aims:* To identify the prevalence of malnutrition risk in patients after a stroke and assess the predictive value of the Malnutrition Universal Screening Tool (MUST) on clinical outcomes. *Patients and Methods:* Using data from electronic records and the Sentinel Stroke National Audit Programme (January 2013 and March 2016), patients aged more than 18 years with confirmed stroke admitted to a tertiary care stroke unit were assessed for risk of malnutrition. The association between malnutrition risk and clinical outcomes was investigated and adjusted for confounding variables. *Results:* Of 1101 patients, 66% were screened at admission. Most patients (n = 571, 78.5%) were identified as being at low risk, 4.1% (n = 30) at medium risk, and 17.4% (n = 126) at high risk of malnutrition. Compared with low risk, patients with medium or high risk of malnutrition were more likely to have a longer hospital stay (IRR 1.30, 95% confidence interval [CI] 1.07, 1.58), and had greater risk of mortality (10.9% versus 3.5%, 95% CI .03, .13). *Conclusions:* Prevalence of malnutrition assessed by MUST in patients after a stroke was relatively low, but nearly a third of patients were not screened. Patients classified as being at medium or high risk of malnutrition were more likely to experience negative outcomes. Early identification of this population may improve outcome if appropriate care is provided.

Key Words: Stroke—malnutrition—MUST—mortality—complications—length of hospital stay

Introduction

Early poststroke complications include dysphagia, infections, recurrence of stroke, increased intracranial pressure, and malnutrition. Documented prevalence of malnutrition in patients after a stroke ranges from 6.1% to 62%[1] and has been shown to affect clinical outcomes.[2,3]

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However, in the majority of patients, malnutrition is considered an avoidable consequence of a stroke.[3] The most obvious indication of malnutrition is rapid weight loss and this pattern of weight change is recognized as an important predictor of poor outcomes.[4] Available evidence indicates that, after a stroke, a reduction in weight of more than 3 kg, both in the short and long term can impact on risk of mortality.[5] Importantly, studies indicate that nutritional interventions can help improve patients' clinical outcomes if initiated early.[6-8]

To provide nutritional interventions to patients at risk of malnutrition, those who are malnourished need to be identified. This can be achieved with the use of a nutritional screening tool, as recommended by national clinical guidelines for stroke which advise screening for malnutrition risk on admission and at least weekly thereafter by trained staff using a structured tool.[9] A number of studies have reported on nutritional status in the stroke population using different assessment methods or screening tools.[2,6,8,10-15] However, a large discrepancy exists in the tools used, time of assessment, and definition of malnutrition.

There is a difference between nutritional screening and nutritional assessment.[16] Nutritional screening tools are designed to be used as rapid and simple methods to identify those at risk of malnutrition, while nutritional assessment involves comprehensive assessment of nutritional status by trained personnel to identify malnutrition, which can then be treated with appropriate nutritional interventions.[17] The most frequently used screening tool in the UK is the Malnutrition Universal Screening Tool (MUST), a feasible way of identifying patients at risk of malnutrition in clinical and community settings,[18] which has been included in the Global Leadership Initiative on Malnutrition, a new consensus on assessment of malnutrition.[19] Although MUST has been validated against nutritional assessment methods and other screening tools[20] in mixed patient populations, the evidence of its predictive value in patients after a stroke is thus far unclear.

The paucity and inconsistency of evidence on the prevalence of malnutrition in patients after a stroke, leaves clinical practitioners with uncertainty. Therefore, the aim of this observational clinical registry and audit was to identify the prevalence of risk of malnutrition in patients after a stroke determined by MUST in a UK based secondary care facility and its association with clinical outcomes including mortality and length of stay (LoS).

Materials and Methods

This was a retrospective analysis of prospectively collected data from local Sentinel Stroke National Audit Programme (SSNAP) and the electronic patient record (EPR) at the Greater Manchester Comprehensive Stroke Centre based at Salford Royal Foundation Trust. All patients with suspected stroke within 48 hours of onset were admitted to the stroke unit based on location of home residence. Patients with a confirmed stroke, aged at least 18 years and with a Salford postcode receiving their ongoing care at Comprehensive Stroke Centre were eligible for the study, and identified using Salford SSNAP data. Core SSNAP data were extracted and merged with additional data from the EPR. The clinical parameters included patients' characteristics, baseline nutritional status including weight and body mass index (BMI); MUST score at admission and before discharge; mortality, National Institutes of Health Stroke Scale (NIHSS scale), modified Rankin scale (mRS), complications and LoS. Ethical approval for this secondary data analysis was sought from the University of Manchester's Ethics Committee (UREC). As all data were collected as part of routine clinical care, following (proportionate) review and consideration by University of Manchester's Ethics Committee, the study was given exemption from the requirement for ethical approval as a clinical registry, service evaluation, and audit. The extraction of data was performed by the Information Technology Department at Salford Royal NHS Foundation Trust using the EPR. These data were matched with that of the Sentinel Stroke National Audit Programme (SSNAP) database by a member of the clinical team and fully anonymized. The research team had access to the anonymized data only. The study was formally registered as a clinical audit at the Clinical Audit Department (reference number 2016151) at Salford Royal NHS Foundation Trust.

MUST Score

MUST score were collected from SSNAP data. Healthcare professionals performed MUST assessment as part of routine hospital admissions procedure and before discharge. The MUST methodology used incorporates three independent variables: *BMI score* (BMI >20.0 = 0, BMI 18.5-20.0 = 1, BMI <18.5 = 2); *unplanned weight loss* in previous 3-6 months (weight loss <5% = 0, weight loss 5-10% = 1 and weight loss >10% = 2); and *acute disease effect score* (a score of 2 was added if a patient was recently affected by a disease and there was no nutritional intake or likely to be no nutritional intake for more than 5 days). For BMI and weight loss, each variable is scored on a scale of 0-2. A total sum of scores is used to categorize the risk of malnutrition as low (0), medium (1), and high (≥2).[21] Details on MUST score assessment can be found at the British Association for Parenteral and Enteral Nutrition website.[22] We further categorized MUST into a dichotomized variable (low risk of malnutrition 0, versus medium to high risk of malnutrition ≥1).

Statistical Methods

Standard descriptive statistics summarized the patient and clinical characteristics. Statistical inference determined the association between prevalence of risk for malnutrition and clinical outcomes, while adjusting for potential confounders in a multiple logistic regression analysis. LoS defined as a count of the days as inpatient was modeled

using a negative binomial regression to investigate the relationship between LoS and MUST. Confounders were identified prior to analysis. Weight, BMI, and mRS were not included due to collinearity. The analysis was adjusted for age, gender, type of stroke, NIHSS scale, and comorbidities. Further (logistic) regression modeling investigating the association between MUST and deaths in hospital, however deaths at 6-months from admission was not possible due to limited death events occurring in those with a MUST score. A Fishers exact test however was possible for death at 6 months and is reported.

Results

Between January 2013 and March 2016, records of 1101 patients who met the eligibility criteria were extracted from EPR and combined with corresponding SSNAP data. The patient's baseline characteristics based on dichotomized MUST score for the total population are shown in Table 1, and mRS at preadmission and discharge by MUST category is presented at Figure 1. Mean age was 73.6 (SD 13.6) years and 94% of patients included were of a Caucasian origin with equal gender distribution. Just over half of patients (n = 563, 51.2%) had a history of hypertension; about a fifth of patients (n = 209, 19%) had diabetes mellitus, atrial fibrillation (n = 197, 17.9%), and a small proportion had (n = 51, 4.4%) congestive heart failure. The vast majority of patients (n = 976, 89.2%) were diagnosed with ischemic stroke, with the remainder (n = 118, 10.8%) being diagnosed with a primary intracerebral hemorrhage. A fifth of patients had a previous transient ischemic attack (n = 218, 19.8%). Based on NIHSS scale,[23] no stroke symptoms (score 0) were present in 10.8% of patients, minor stroke (score 1-4) were experienced by 40.2%, moderate stroke (score 5-15) by 33.5%, moderate to severe stroke (score 16-20) by 7.3% and severe stroke (score 21-42) by 8.3% patients (Table 1).

MUST Score

A MUST score was recorded in 66% of patients both on admission and prior to discharge from hospital. On admission, the majority of patients 78.5% (n = 571) were at low risk of malnutrition (MUST score 0), 4.1% (n = 30) were considered to be at medium risk (MUST score 1) and 17.4% (n = 126) were classified as being at high risk of malnutrition (MUST score ≥2). At the point of discharge from hospital, the number of patients with low risk of malnutrition increased to 85.2% (n = 618), the number of patients with medium risk increased to 5.8 % (n = 42) and the number of patients in high risk group decreased to 9% (n = 65). As expected, 38 (90.5%) of patients with BMI between 18.5 and 20 kg/m^2 and 18 (100%) of patients with BMI less than 18 kg/m^2 were identified as being at medium to high risk of malnutrition.

Negative Binomial Regression

Table 2 reports the incidence rate ratios (IRR) and corresponding 95% confidence intervals for the adjusted association between LoS and risk of malnutrition defined by a dichotomised MUST score. Compared to low risk, medium or high risk of malnutrition was associated with an IRR = 1.30 (95% confidence interval [CI] 1.07-1.58) indicating a 30% increase in the risk of a longer hospital stay. Additionally, a linear increase in risk of a longer hospital stay was observed for NIHSS scores increasing in severity from "moderate" to "severe" (IRR = 1.49, 2.64, and 3.14) when compared to no symptoms. Interestingly, minor stroke was associated with a 30% decrease compared to no symptoms (IRR = .72, 95% CI .56-.93). Of the comorbidities, only diabetes was associated with an increase in LoS of 31% (IRR = 1.31, 95% CI 1.07-1.61).

LoS and Complications

Median LoS for all patients was 7 days and ranged between 0 and 147 days. Twenty patients (2%) were diagnosed with urinary tract infection in hospital. Pneumonia affected 53 patients (5.4%). By comparison, patients who were not assessed for MUST (n = 374), had a median LoS of 6 days and ranged between 0 and 147 days. Urinary tract infections were identified in 3 (.8%) and pneumonia in 33 (8.8%) of the non-MUST assessed patients (Table 3).

Mortality

From the total sample of 1101 patients, 214 (19.4%) patients had died at 6-months follow up, and from these, 161 (14.6%) died in hospital. From 161 patients who died in hospital, only 1 patient had been assessed for malnutrition with MUST score on admission. Survival of patients who died in hospital was median 3.5 (range 0-147) days. Of these, 68 (42.5%) patients did not survive for longer than a day. For patients with a MUST greater than or equal to 1 (indicating a medium to high risk of malnutrition), the number of deaths was greater compared to those with a MUST = 0 (indicating a low risk of malnutrition), 17/159 (10.9%) versus n = 20/571 (3.5%), respectively, $P = .001$. Main cause of the death at 6 months was recorded in 149 out of 214 patients, an ischemic stroke in 44% (n = 66), spontaneous cerebral hemorrhage 16% (n = 24), pneumonia in 14% (n = 21), cancer 11% (n = 16) and other in 15% (n = 22) of patients (Table 3).

Discussion

In this observational study, we examined the prevalence of risk for malnutrition in patients after a stroke and described the use of MUST as a previously validated screening tool[20] to determine future risk of malnutrition. From a total population of 1101 patients admitted to the hospital during a 3-year period, only two-thirds were screened using MUST. A similar proportion of patients

Table 1. *Characteristics of patients admitted to hospital with stroke*

	Dichotomised MUST score at admission n = 727			Total n (%) N = 1101	Total missing n (%)
	Low risk	Medium to high risk	MUST not reported n (%)		
Age [years] Mean (SD)	71 (13.4)	74 (13.7)	374 (34.0)	73.6 (13.6)	0
Weight at admission [kg] Mean (SD) n = 627	74.52 (17.98)	68.43 (21.86)	528 (48.0)	73.2 (18.9)	474 (43.1)
Gender n (%) n = 1094					
Male	281 (78.05)	79 (21.95)	377 (34.2)	540 (49.4)	7
Female	288 (20.88)	76 (79.12)		554 (50.6)	
Congestive heart failure n (%)					
Yes	22 (81.48)	5 (18.52)	374 (34.0)	51 (4.6)	0
No	549 (78.43)	151 (21.57)		1050 (95.4)	
Hypertension n (%) n = 1099					
Yes	286 (77.93)	81 (22.07)	375 (34.1%)	563 (51.2)	2
No	285 (79.39)	74 (20.61)		536 (48.8)	
Atrial fibrillation n (%)					
Yes	92 (75.41)	30 (24.59)	374 (34.0)	197 (17.9)	0
No	479 (79.17)	126 (20.83)		904 (82.1)	
Diabetes mellitus n (%) n = 1100					
Yes	113 (79.02)	30 (20.98)	374 (34.0)	209 (19)	1
No	458 (78.42)	126 (21.58)		891 (81)	
Transient ischemic attack n (%)					
Yes	128 (82.05)	28 (73.95)	374 (34.0)	218 (19.8)	0
No	443 (77.58)	128 (22.42)		883 (80.2)	
Type of stroke n (%) n = 1094					
Infarction	522 (78.61)	142 (21.39)	381 (34.6)	976 (89.2)	7
Hemorrhage	43 (76.79)	13 (23.21)		118 (10.8)	
NIHS scale					
No stroke symptoms	67 (79.8)	17 (20.2)	374 (34)	118 (10.7)	0
Minor stroke	297 (87.6)	42 (12.4)		443 (40.2)	
Moderate stroke	183 (74.1)	64 (25.9)		369 (33.5)	
Moderate to severe stroke	18 (47.4)	20 (52.6)		80 (7.3)	
Severe stroke	6 (31.6)	13 (68.4)		91 (8.3)	

Abbreviations: Kg, kilograms; MUST, Malnutrition Universal Screening Tool; NIHS, National Institutes of Health Stroke Scale; SD, standard deviation.
Score 0 = no symptoms, score 1-4 minor stroke, score 5-15 moderate stroke, score 16-20 moderate to severe stroke, and score 21-42 severe stroke.
Reported significant difference between MUST score groups.

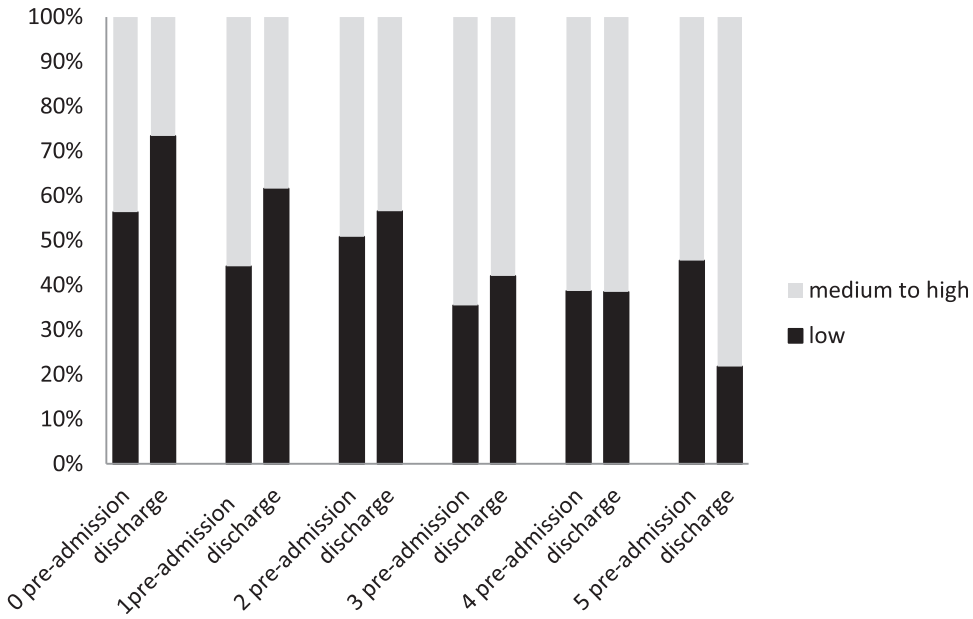

Figure 1. *Modified Rankin scale at pre-admission (N = 1101) and discharge (n = 983) categorized using medium to high and low risk of malnutrition.*

Table 2. *Multivariate negative binomial regression investigating association between risk of malnutrition defined by MUST score at admission and length of hospital stay (n = 715)*

Predictor	IRR	95% CI
MUST risk	1.30**	1.07-1.58
Confounders		
Age	1.00	0.10-1.01
Gender	0.98	0.84-1.15
Atrial fibrillation	1.20	0.97-1.49
Congestive heart failure	1.10	0.73-1.66
Hypertension	1.02	0.87-1.20
Diabetes mellitus	1.31**	1.07-1.61
Transient ischemic attack	1.08	0.89-1.30
Type of stroke (infarction/hemorrhage)	1.18	0.90-1.57
NIHSS scale [Ref category No symptoms]		
Severe stroke	3.14***	1.87-5.28
Moderate to severe stroke	2.64***	1.77-3.95
Moderate stroke	1.49**	1.14-1.94
Minor stroke	0.72*	0.56-0.93

Abbreviations: CI, confidence interval; IRR, Incidence Rate Ratio; NIHSS National Institutes of Health Stroke Scale; Ref, reference.

Reported significant:

*$P \leq .05$.

**$P \leq .01$.

***$P \leq .001$.

screened for malnutrition was previously reported by the Food Trial Collaboration.[6] This indicates that around one third of patients with a potential risk of malnutrition are not captured by routine screening. Due to the records based dataset in the form of EPR data merged with SSNAP, we were unable to ascertain whether the reduced numbers of patients screened is related to lack of assessment or missing data.

In our sample screened for malnutrition, 21.5% of people admitted to the hospital with stroke were at moderate to high risk of malnutrition. However, due to the paucity of evidence on risk of malnutrition assessed by MUST in patients after stroke, our data can only be compared with 1 other study of a similar design that showed 36% risk of malnutrition.[24] Surprisingly, we observed a higher proportion of patients who were at low risk of malnutrition at discharge compared to admission. This decrease (in the high risk prevalence) might reflect good nutritional care provided to patients prior to hospital discharge at our center. A further investigation detailing the care pathway might provide more insight into observed more favorable rate of malnutrition risk.

The results of this study concur with previous data, demonstrating the ability of MUST to independently predict negative outcomes in patients after a stroke,[24] raising the possibility that intervening may improve clinical outcomes. Also, it was previously shown that up to one quarter of patients after a stroke became malnourished within the first week of admission, and the risk increased with prolonged hospital stay.[10,15] In our study, a median LoS of 7 days was lower than 13 days and 25 days previously reported.[6,25] This was possibly affected by a relatively low prevalence of malnutrition in the population.

Although the level of malnutrition in patients after admission with stroke is relatively low in comparison to other disease states,[26] possibly reflecting their acute presentation, these patients still require clinical recognition and support, since malnutrition has been frequently reported as an independent prognostic factor of

Table 3. *Clinical outcomes of patients after stroke based on assessed MUST score (N = 1101)*

	Dichotomized MUST score at admission n = 727			
	Low risk n = 571	Medium to high risk n = 156	MUST not reported n = 374	Total N = 1101
LoS median (range) (days) n = 822	6 (0-123)	12.5 (1-116)	6 (0-147)	7.0 (0-147)
Number of hospital deaths n (%)	0	1 (0.6)	160 (42.8)	161 (14.6)
Total deaths at 6 months n (%)	20 (3.5)	17 (10.9)	177 (47.3)	214 (19.4)
Number of patients with urinary tract infection n (%)	9 (1.6)	8 (5.1)	3 (.8)	20 (2.0)
Number of patients with pneumonia n (%)	12 (2.1)	8 (5.1)	33 (8.8)	53 (5.4)
Main cause of death at 6 months n (%)	n = 20	n = 17	n = 112	n = 149
Ischemic stroke	4 (20.0)	7 (41.2)	55 (49.1)	66 (44)
Spontaneous cerebral hemorrhage	1 (5.0)	0	19 (16.9)	24 (16)
Pneumonia	4 (20.0)	3 (17.6)	18 (16.1)	21 (14)
Cancer	6 (30.0)	3 (17.6)	7 (6.3)	16 (7.1)
Other	5 (25.0)	4 (23.5)	13 (11.6)	22 (15)

Abbreviations: LoS, length of hospital stay; SCH, Spontaneous cerebral hemorrhage.

poststroke complications and poor clinical outcomes.[2,14,15] The importance of addressing malnutrition is underlined by the cost of hospitalization for patients with stroke, which was estimated to be up to 77% higher in patients who have a high risk of malnutrition compared to those patients who have a low risk.[13,24] Thus, early identification of patients at risk and provision of appropriate nutritional support might help not only to reduce poorer clinical outcomes in patients but also reduce the burden on financial resources.

As with all retrospective studies, the main limitation of this study was the use of data collected for clinical audit and patient's records. We were limited in records availability and consequent missing data for individual outcomes. Also, the impact of dysphagia and poststroke depression, both linked to oral intake and nutritional status were not directly factored into our analyses, which may have impacted on outcomes. Data were analyzed from a single hospital in the UK and the rates of screening may reflect a degree of selection bias. Moreover, the MUST score was recorded in only two thirds of patients admitted to hospital with a stroke, which limits our ability to draw strong conclusions on prevalence of malnutrition and its association with clinical outcomes. However, despite the limitations, these data provide an insight into a risk of malnutrition in a large number of participants after a stroke.

Summary and Conclusion

Our findings show that there is a significant group of patients at risk of malnutrition, and malnutrition risk as identified by MUST is associated with longer hospital stay even after adjustment for confounders. Hence, these patients require clinical recognition, and further prospective studies are warranted to evaluate any effect of nutritional interventions. Importantly, our data also show that there are substantial numbers of patients who are not screened for malnutrition on admission to hospital. These patients might be at risk of malnutrition but remain unidentified.

Declaration of conflict of interest

Conflicting interests: The authors declare no conflict of interest.

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References

1. Foley N, Salter K, Robertson J, et al. Which reported estimate of the prevalence of malnutrition after stroke is valid? Stroke 2009;40:e66-e74.
2. Martineau J, Bauer J, Isenring E, et al. Malnutrition determined by the patient-generated subjective global assessment is associated with poor outcomes in acute stroke patients. Clin Nutr 2005;24:1073-1077.
3. Bouziana S, Tziomalos K. Malnutrition in patients with acute stroke. J Nutr Metab 2011;2011:167898.
4. Martin L, Senesse P, Gioulbasanis I, et al. Diagnostic criteria for the classification of cancer-associated weight loss. J Clin Oncol 2015;33:90-99.
5. Jonsson A, Lindgren I, Norrving B, et al. Weight loss after stroke: a population-based study from the Lund Stroke Register. Stroke 2008;39:918-923.
6. Food Trial Collaboration. Poor nutritional status on admission predicts poor outcomes after stroke: observational data from the FOOD trial. 2003. Report No.: 1524-4628 (Electronic) 0039-2499 (Linking) Contract No.: 6.
7. Axelsson K, Asplund K, Norberg A, et al. Nutritional status in patients with acute stroke. Acta medica Scandinavica 1988;224:217-224.

8. Gariballa S, Parker S, Taub N, et al. Influence of nutritional status on clinical outcome after acute stroke. Am J Clin Nutr 1998;68:275-281.
9. Rudd A, Bowen A, Young G, et al. National clinical guideline for stroke: 5th edition 2016. Clin Med 2017;7:69-71.
10. Davalos A, Ricart W, Gonzalez-Huix F, et al. Effect of malnutrition after acute stroke on clinical outcome. Stroke 1996;27:1028-1032.
11. Davis J, Wong A, Schluter P, et al. Impact of premorbid undernutrition on outcome in stroke patients. Stroke 2004;35:1930-1934.
12. Chai J, Chu F, Chow T, et al. Prevalence of malnutrition and its risk factors in stroke patients residing in an infirmary. Singap Med J 2008;49:290-296.
13. Lim S, Ong K, Chan Y, et al. Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. Clin Nutr 2012;31:345-350.
14. Shen H, Chen H, Peng L, et al. Impact of nutritional status on long-term functional outcomes of post-acute stroke patients in Taiwan. Arch Gerontol Geriatrics 2011;53:e149-e152.
15. Yoo S, Kim J, Kwon S, et al. Undernutrition as a predictor of poor clinical outcomes in acute ischemic stroke patients. Arch Neurol 2008;65:39-43.
16. Charney P. Nutrition screening vs nutrition assessment: how do they differ? Nutr Clin Pract 2008;23:366-372.
17. Young A, Kidston S, Banks M, et al. Malnutrition screening tools: comparison against two validated nutrition assessment methods in older medical inpatients. Nutrition 2013;29:101-106.
18. Elia M, Russell C. Nutrition screening survey in the UK and Republic of Ireland in 2011. BAPEN; 2012.
19. Cederholm T, Jensen G, Correia M, et al. GLIM criteria for the diagnosis of malnutrition – a consensus report from the global clinical nutrition community. Clin Nutr 2018.
20. Stratton R, Hackston A, Longmore D, et al. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' ("MUST") for adults. Br J Nutr 2004;92:799-808.
21. Elia M. THE "MUST" REPORT nutritional screening of adults: a multidisciplinary responsibility, Redditch: BAPEN; 2003.
22. BAPEN. Malnutrition Universal Screening Tool 2003. 2019. Available from: https://www.bapen.org.uk/pdfs/must/must_full.pdf.
23. Hage V. The NIH stroke scale: a window into neurological status. NurseCom Nurs Spectr (Greater Chicago) 2011;24:44-49.
24. Gomes F, Emery P, Weekes C. Risk of malnutrition is an independent predictor of mortality, length of hospital stay, and hospitalization costs in stroke patients. J Stroke Cerebrovasc Dis 2016;25:799-806.
25. Ha L, Hauge T, Spenning A, et al. Individual, nutritional support prevents undernutrition, increases muscle strength and improves QoL among elderly at nutritional risk hospitalized for acute stroke: a randomized, controlled trial. Clin Nutr 2010;29:567-573.
26. Russell C, Elia M. Nutrition screening survey in hospitals in the UK, 2007-2011. BAPEN; 2014.