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The effect of body mass index on inpatient rehabilitation outcome after stroke in an East-Asian cohort: a prospective study

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ABSTRACT

Introduction: We examined the association between admission body mass index (BMI) and discharge rehabilitation functional outcome using the Functional Independence Measure (FIM) in an East-Asian cohort of stroke patients during inpatient rehabilitation.

Methods: A prospective observational cohort study of stroke patients admitted to a single inpatient rehabilitation unit was conducted. Using the World Health Organisation Asian standards, BMI was classified as underweight (< 18.5 kg/m^2), normal (18.5–22.9 kg/m^2) and overweight (≥ 23 kg/m^2). The primary outcome measure was discharge FIM, and secondary outcomes included FIM gain, FIM efficiency and FIM effectiveness.

Results: 247 stroke subjects were enrolled (mean age 59.48 [SD 12.35] years, 64.4% [159] male, 52.6% [130] ischaemic stroke). The distributions of underweight, normal and overweight BMI were 10.9% (27), 33.2% (82), and 55.9% (138) respectively on admission and 11.7% (29), 38.1% (94), and 50.2% (124) respectively on discharge. Significant small decreases in BMI from admission (median [IQR]: 23.58 [23.40, 24.70]) to discharge (median [IQR]: 23.12 [22.99, 24.21]) ($p < 0.001$) were found. Similarly, clinically significant FIM gains (mean ΔFIM 26.71 [95% CI: 24.73, 28.69], $p < 0.001$) were noted after 36 days of median length of stay. No significant relationships were found between BMI and discharge FIM ($p = 0.600$), FIM gain ($p = 0.254$), FIM efficiency ($p = 0.412$) nor FIM effectiveness ($p = 0.796$).

Conclusion: Findings from this study unequivocally support the benefits of acute inpatient stroke rehabilitation. Patients in the obese BMI range tended to normalise during rehabilitation. BMI, whether underweight, normal, or overweight was not correlated with discharge FIM.

Keywords: body mass index, functional independence measure, obese, rehabilitation, stroke

INTRODUCTION

Stroke is the third leading cause of death and disability globally.[1] Obesity is a well-known risk factor for stroke and premature death acting through cardiovascular disease.[2] However, obesity based on the Body Mass Index (BMI), may be associated with greater survival among the hospitalised elderly and those with chronic diseases, example in cardiovascular disease, diabetes, and end stage renal disease.[3-6] This is termed an “obesity paradox”.

With regards to functional recovery after stroke, the literature also suggests a trend towards an obesity paradox with patients of higher than normal BMI, having a better functional outcome compared to their thinner counterparts. In a Caucasian study, overweight stroke patients at any age group, had better functional progress measured by Functional Independence Measure (FIM).[7] Similarly, two studies from Asian cohorts also reported similar findings. Lu et al reported a large study from the China National Stroke Registry in which overweight patients were associated with favourable 3-month functional recovery, measured Modified Rankin Scale (mRS).[8] Jang et al reported that better functional outcomes measured by FIM among acute first-ever ischaemic stroke survivors who were extremely obese and aged 65 years or older, but no association was noted in younger stroke survivors aged under 65 across all categories.[9]

In regard to the relationship between BMI with inpatient rehabilitation outcome, such as Functional Independence Measure (FIM),[10] there is a paucity of local data as to whether BMI impacts rehabilitation outcome and redirect future stroke-care pathways or resource allocation to management of abnormal BMI.

Hence, the main objectives of this study were to; (i) describe the demographic, clinical and rehabilitation characteristics of a cohort of stroke subjects on admission and discharge from rehabilitation; (ii) compare changes in admission and discharge BMI after inpatient rehabilitation; and (iii) investigate if there were correlations between BMI with discharge rehabilitation outcome.

METHODS

Between 31st January 2019 to 31st January 2020, a single-centre, prospective observational cohort study involving stroke patients undergoing inpatient rehabilitation was conducted. Ethics approval was granted by the National Healthcare Group Domain Specific Review Boards. (NHG-DSRB 2018/01084). The study was also registered with www.clinicaltrials.gov (NCT 04625933). All subjects or their next-of-kin gave written informed consent prior to enrolment.

The study was conducted at the Tan Tock Seng Rehabilitation Centre, Singapore which accepts referrals from acute stroke units nationwide. Patients were transferred to the rehabilitation center after preliminary screening by physiatrists. All patients were offered intensive multidisciplinary rehabilitation (3 hours daily, 5.5 days a week), including 60 minutes/day each of physiotherapist, occupational therapist, and speech therapist-supervised therapy, focused on early mobilization, verticalization, ambulation and prevention of complications. Robot-aided locomotor therapies were also prescribed where clinically indicated. Dieticians reviewed patients with neurogenic dysphagia with suboptimal oral intake, nasogastric or gastrostomy feeding on a weekly basis. Weekly rehabilitation team conferences were held to review goals, functional progress, and discharge planning. For this study, the Functional Independence Measure (FIM) was the main functional outcome measure.[10]

Subjects were enrolled based on the following inclusion criteria: (i) first-ever clinical stroke (ischemic or hemorrhagic) diagnosed by acute neurologists or neurosurgeons and confirmed on Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) brain imaging, and (ii) aged 21 years old and above.

Subjects were excluded based on the following exclusion criteria: (i) non-stroke diagnosis (e.g. traumatic brain injury, subarachnoid hemorrhage), (ii) rehabilitation was not the primary reason for the inpatient admission, (iii) failure to complete the rehabilitation program due to either an acute transfer off the rehabilitation center or an against-medical-advice discharge, (iv) incomplete or missing BMI and FIM data, and (v) patients who were not of Asian ethnicity.

Based on the following outcome variables, we constructed a data collection form. Outcome measures included age (years), gender (male/female), stroke type (ischemic/haemorrhagic), length of stay (LOS) in rehabilitation unit in days, discharge outcome (home/institutional care), admission serum albumin level, admission and discharge BMI, admission and discharge total, subset motor and cognitive FIM, FIM gain, FIM efficiency and FIM effectiveness.

Serum albumin is a common biomarker of nutritional status.[(11)] Serum albumin was drawn within 72 hours of stroke onset. Low serum albumin level was defined as <35 g/L.[(12)]

BMI was chosen as the primary indicator as a measure of relative obesity due to its simplicity and strong correlation with body fat and health risks. It is inexpensive, easily available, and fairly accurate.[(13)] BMI was calculated using the formula of body weight (in kilograms/kg) divided by the square of height (in meters^2/ m^2) and measured within 72 hours of admission and planned discharge from inpatient rehabilitation. With reference to WHO Asian standards, BMI was further categorised into; (i) underweight (BMI < 18.5kg/m^2), (ii) normal (BMI 18.5-22.9kg/m^2), and (iii) overweight (BMI $\geq$ 23kg/m^2).[(3)]

Due to stroke-related motor impairments, customisation was required to obtain body weight and height measurements to derive patients' BMI. For patients who could sit unsupported, a weighing chair scale was used to measure body weight (seca 944®, https://us.secashop.com/products/chair-scales). For patients with poor sitting balance, a multifunctional wheelchair scale (seca 665®, https://www.seca.com/en_ee/products/all-products/product-details/seca665.html) was used to measure body weight. Height was measured with using a standard measuring tape. For patients who were able to stand without support, height was measured in standing position with feet flat and back straight against a wall. For patients who were not able to stand unsupported, height was measured in supine position with both legs extended and feet in dorsiflexion at end of bed.

The main primary outcome measure during rehabilitation, FIM was measured within 72 hours of admission and discharge by rehabilitation therapists, all of whom were trained and certified in the use of the FIM score. The FIM is an 18-item instrument comprising 13 motor items and 5 cognitive items, with each item graded on a 7-point ordinal scale (1 denotes complete dependence and 7 denotes complete independence). It assesses the ability to perform activities of daily living (ADLs) across 6 areas (self-care, sphincter control, transfers, locomotion, communication, and social cognition). Total admission FIM scores, total discharge FIM scores (18 – 126 points), motor FIM (13 – 91 points) and cognitive FIM (5 – 35 points), were tabulated.

Secondary outcomes included, (i) FIM gain, defined as [discharge FIM – admission FIM]; (ii) FIM efficiency, defined as [FIM gain / rehabilitation LOS (days); and (iii) FIM effectiveness defined as [FIM gain/126 -admission FIM scores].

Data was analysed with IBM SPSS version 23.0 statistical software. Descriptive statistics were used to summarise subjects' characteristics. Descriptive statistics were used for baseline demographics, clinical, and rehabilitation characteristics. The groups were compared using One-way Anova and Kruskal Wallis test. Simple and multiple linear regression were used, with total, subset motor and cognition FIM, FIM gain, FIM efficiency and FIM effectiveness as dependent variables and age, gender, admission serum albumin level, admission, and discharge BMI as independent variables. All statistical tests were 2-sided, and the level of significance was set at $p < 0.05$ for all tests.

RESULTS

During the study period, 247 stroke patients were enrolled, and all completed research interventions without dropouts or adverse events. The baseline demographic, clinical and rehabilitation characteristics of the sample are shown in Table I. The distributions of underweight, normal, and overweight BMI were 10.9% (27), 33.2% (82), and 55.9% (138) respectively on admission to rehabilitation and 11.7% (29), 38.1% (94), and 50.2% (124) respectively on discharge from rehabilitation. Over a median LOS-R of 5 weeks, the overweight BMI range categories demonstrated a significant reduction to a normal BMI range ($p < 0.001$). The mean serum albumin level on admission for underweight BMI category was 38.15 g/L (SD 4.78) with only 18.5% of underweight patients had low serum albumin level. There was a statistically significant but weak correlation between serum albumin on admission with admission BMI ($p = 0.021$, $r = 0.147$). Significant gains in total, subset motor and cognition FIM scores were also found post-rehabilitation ($p < 0.001$). Linear regression analysis with discharge motor, cognition and total FIM, FIM gain, FIM efficiency and FIM effectiveness as dependent variables, while age, gender, type of stroke, serum albumin level on admission, admission and discharge BMI as independent variables were presented in Table II. There was a significant linear negative relationship between ages with motor and total discharge FIM, FIM Gain, and FIM effectiveness but not discharge cognitive FIM and FIM efficiency. Besides, there was a significant relationship found between serum albumin level on admission with motor, cognition, and total discharge FIM, and FIM effectiveness but not FIM Gain and FIM efficiency. There were no statistically significant differences between groups even after adjustment for age and gender. There was a trend for the underweight BMI group showing higher improvement in FIM gain, and FIM effectiveness, though not statistically significant.

DISCUSSION

We assessed the association between BMI, discharge FIM, FIM gain, FIM efficiency and FIM effectiveness in 247 acute post-stroke rehabilitation patients. Our results show that BMI categories in any direction were not associated with either admission or discharge rehabilitation functional status measured by FIM.

Our cohort's mean age of 59.5 years was 9 years younger than the mean age of stroke, with a 2.5 x higher proportion of haemorrhagic stroke subtype (47.4% cohort vs 18.6% 2018 registry) reported in the Singapore Stroke Registry.(14) Our cohort's age was also generally younger than the mean age of participants in studies conducted in United States, China, and Israel, i.e. 65, 63 and 67 years respectively.(7,8,15) This was likely related to pre-admission selection related to national guidelines for older stroke survivors aged >65 years being admitted to a community hospital and more complex and severe haemorrhagic strokes being admitted to tertiary rehabilitation centres such as TTSH Rehabilitation Centre.(16) Thus, our findings would lack generalisability to the general stroke population.

WHO data states that Singapore has the second highest prevalence of overweight persons in Southeast Asia.(17) More than half (55.5%) of our cohort were overweight (BMI >23.0 kg/m2) at the point of rehabilitation admission. Of these, 35.5% (n = 49) had BMI ≥ 23 - 24.9 kg/m2 and 64.5% (n = 89) had BMI ≥ 25 kg/m2. Being overweight is well known to increase risk of stroke, post-stroke mortality and morbidity and gait dysfunction compared to their thin counterparts, thus affecting discharge FIM and FIM gain.(18-20)

Beninato et al report the minimal clinically important difference (MCID) after stroke for total FIM, motor, and cognitive FIM as 22, 17, and 3 respectively.(21) Overall, significant changes in FIM gain, exceeding MCID reference ranges of mean total, motor and cognition

FIM of 26.7, 21, and 5.8 respectively, regardless of BMI class were achieved in our cohort. The underweight BMI group tended to show higher FIM gains and FIM effectiveness compared with normal and overweight BMI respectively ($p > 0 .05$), although these differences did not reach statistical significance. Our findings contradict with Kimura et al which suggested that underweight patients admitted for subacute stroke had poorer functional recovery.[22] For our younger stroke cohort, age ($\beta = -0.477$, $p<0.05$) and serum albumin level at admission ($\beta = 1.369$, $p<0.001$) was shown to be a stronger predictor than BMI range in any direction, and possibly protective against a poorer rehabilitation outcome at discharge. Serum albumin level on admission to rehabilitation significantly predicted better FIM total, motor, and cognition FIM, with Δ1.369 total FIM points for each Δgram of albumin, while age predicted total and motor FIM and but not cognitive FIM to a lesser extent (Table II). Hence findings from study imply we should pay more attention to monitoring and optimising albumin levels, an important nutritional parameter, throughout rehabilitation, rather than BMI.

Overall, our findings show that BMI categories in any direction were not associated with, nor predictive of rehabilitation functional outcome as measured by discharge FIM score or the ability to make significant functional gains after inpatient rehabilitation. All three BMI categories achieved significant FIM gains (total, motor and cognitive). Thinner patients tended to achieve insignificant higher FIM gains compared to their obese counterparts, thus our study findings differ from the "obesity paradox" alluded to in larger population-based studies.[7-9] This might be because the majority of underweight patients were nutritionally replete as only 18.5% had low albumin levels. We speculate that higher lean muscle mass in the underweight BMI class could augur higher functional reserves thus better FIM outcomes, and younger stroke cohorts were less likely to have age-dependent sarcopenia.

Conversely, the BMI reduction of Δ0.46 during inpatient rehabilitation among overweight groups, either through controlled caloric restriction or through healthier hospital diet might have been excessively rapid, thus inducing greater losses of lean body mass, with possible negative effects on functional recovery. This was speculative as data on body composition, muscle mass, bone mass and fat mass were not available in this study.

While excessively high BMI in patients with severe stroke-related motor impairments and maximal dependency would place immense challenges on therapists and nurses in terms of transfers out of bed/chairs, mobilisation and safe handling, the presence of robot-aided locomotor devices, mobile hoists and assistive devices possibly mitigated such difficulties allowing overweight patients to mobilise safely and adequately, thus achieving comparable total FIM and motor FIM gains. Thus, our findings suggest that BMI in any direction does not impair patients' abilities to attain functional benefits during inpatient rehabilitation. Age and serum albumin level at rehabilitation were important predictors, with the latter a low-lying therapeutic target.

The study had several limitations: (i) single-centre experience; (ii) relatively small sample size; (iii) selection biases related to national stroke rehabilitation admission guidelines[16] where mild stroke survivors were discharged home with early supported post-stroke discharge home services, while elderly patients received rehabilitation community hospitals; both groups were under-represented in our sample who had a young mean age of <60 years and mean admission FIM of 55; (iv) the presence of relevant variables such as premorbid socioeconomic status, poststroke dysphagia and depression were not included in the study; and finally, (v) a lack of long-term follow up at 6 months post-stroke with regards to the trajectory of FIM and BMI. This did not allow an analysis of prediction of BMI with functional outcome at 6 to 12 months post-stroke.

To our knowledge, this is the first study to investigate if BMI at the commencement of inpatient rehabilitation has an effect on eventual post-discharge rehabilitation outcome. In conclusion, this study concurs with other studies with regards to the undisputed benefit of an intensive post-stroke rehabilitation unit care in those with moderate-severe stroke, to significantly improve function, reduce disability and return patients' home. Findings from this study also suggest that BMI in either direction does not significantly impact nor predict the ability to achieve functional independence or demonstrate functional gains after inpatient rehabilitation. Long-term follow-up of this cohort is a logical next step to study the impact of BMI.

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Table I. Baseline demographic, clinical and functional characteristics of subjects (n = 247).

Variables		Total (n = 247)	Underweight (n = 27)	Normal (n = 82)	Overweight (n = 138)	p
Age (years), mean (SD)		59.48 (12.35)	60.96 (15.09)	62.27 (10.16)	57.53 (12.68)	**0.018**
Gender (male), *n* (%)		159 (64.4)	18 (66.7)	53 (64.6)	88 (63.8)	0.958
Type of stroke, *n* (%)	Ischaemic	130 (52.6)	14 (51.9)	41 (50)	75 (54.3)	0.822
	Haemorrhagic	117 (47.4)	13 (48.1)	41 (50)	63 (45.7)	
Days in rehabilitation, median (IQR)		36 (37.9, 43.1)	36 (33.07, 46.48)	36 (35.91, 44.72)	36 (37.03, 44.51)	0.984
Discharge destination, *n* (%)	Home	210 (85)	23 (85.2)	62 (75.6)	125 (90.6)	**0.006**
	Community hospital	25 (10.1)	3 (11.1)	12 (14.6)	10 (7.2)	
	Nursing home	12 (4.9)	1 (3.7)	8 (9.8)	3 (2.2)	
Serum albumin level (g/L) on admission, mean (SD)		38.73 (4.26)	38.15 (4.78)	37.87 (4.59)	39.36 (3.86)	**0.032**
BMI (kg/m2) on admission, mean (SD)		24.05 (5.18)	16.33 (1.28)	20.99 (1.13)	27.37 (4.31)	< **0.001**
BMI (kg/m2) on discharge, mean (SD)		23.60 (4.83)	16.81 (1.38)	20.74 (1.28)	26.62 (4.18)	< **0.001**
FIM score on admission, mean (SD)	Motor	35.22 (16.06)	32.07 (15.03)	36.44 (15.33)	35.11 (16.68)	0.572
	Cognition	20.04 (10.24)	17.15 (9.66)	19.91 (10.51)	20.69 (10.16)	0.731
	Total	55.34 (23.77)	49.22 (22.51)	56.35 (22.88)	55.93 (24.51)	0.547
FIM score on discharge, mean (SD)	Motor	56.22 (19.42)	54.85 (19.56)	55.71 (19.42)	56.80 (19.51)	0.917
	Cognition	25.85 (8.65)	23.81 (9.02)	25.15 (9.29)	26.67 (8.13)	0.103
	Total	82.04 (25.76)	78.68 (27.50)	80.85 (26.08)	83.41 (25.31)	0.600
FIM Gain, mean (SD)	Motor	21 (12.16)	22.78 (11.56)	19.27 (12.72)	21.69 (11.90)	0.915
	Cognition	5.81 (6.60)	6.67 (5.16)	5.23 (6.96)	5.98 (6.64)	0.531
	Total	26.71 (15.79)	29.44 (14.65)	24.50 (16.16)	27.49 (15.72)	0.254
FIM Efficiency, median (IQR)	Motor	0.57 (0.60, 0.75)	0.64 (0.49, 0.81)	0.44 (0.51, 0.79)	0.61 (0.60, 0.79)	0.428
	Cognition	0.09 (0.14, 0.22)	0.15 (0.11, 0.27)	0.06 (0.10, 0.29)	0.09 (0.13, 0.21)	0.093
	Total	0.74 (0.75, 0.95)	0.79 (0.63, 1.06)	0.62 (0.63, 1.06)	0.79 (0.74, 0.98)	0.412
FIM Effectiveness, mean (SD)	Motor	0.41 (0.24)	0.42 (0.25)	0.38 (0.25)	0.42 (0.24)	0.739
	Cognition	0.39 (0.35)	0.44 (0.33)	0.36 (0.37)	0.40 (0.35)	0.657
	Total	0.41 (0.24)	0.43 (0.25)	0.39 (0.24)	0.42 (0.23)	0.796

SD: standard deviation; IQR: interquartile range; BMI: body mass index; FIM: functional independence measure

Table II. Results of linear and multiple regression analysis for discharge total and subset FIM, FIM Gain, FIM efficiency and FIM effectiveness (n = 247)

Dependent variables	Independent variables	Simple Linear Regression		Multiple Linear Regression	
		b (95% CI)	**p-value**	**b (95% CI)**	**p-value**
Discharge Motor FIM	Age (years)	-0.332 (-0.526, -0.139)	**p=0.001**	-0.345 (-0.544, -0.145)	**p=0.001**
	Gender	2.853 (-2.227, 7.932)	p>0.05	2.048 (-2.875, 6.971)	p>0.05
	Type of stroke	-4.012 (-8.870, 0.846)	p>0.05	-4.205 (-9.036, -0.627)	p>0.05
	Albumin level (g/L)	1.003 (0.444, 1.563)	**p<0.001**	0.889 (0.327, 1.451)	**p<0.05**
	Admission BMI (kg/m2)	-0.60 (-0.532, 0.412)	p>0.05	-0.778 (-2.511, 0.954)	p>0.05
	Discharge BMI (kg/m2)	0.011 (-0.495, 0.516)	p>0.05	0.524 (-1.341, 2.390)	p>0.05
Discharge Cognition FIM	Age (years)	0.102 (-0.189, -0.015)	p>0.05	-0.086 (-0.175, 0.003)	p>0.05
	Gender	-0.339 (-2.606, 1.929)	p>0.05	-0.567 (-2.764, 1.629)	p>0.05
	Type of stroke	-1.810 (-3.973, 0.353)	p>0.05	-1.689 (-3.845, 0.467)	p>0.05
	Albumin level (g/L)	0.543 (0.444, 1.563)	**p<0.001**	0.479 (0.228, 0.730)	**p<0.001**
	Admission BMI (kg/m2)	0.155 (-0.054, 0.365)	p>0.05	-0.410 (-1.183, 0.363)	p>0.05
	Discharge BMI (kg/m2)	0.211 (-0.013, 0.434)	p>0.05	-0.531 (-0.301, 1.363)	p>0.05
Discharge Total FIM	Age (years)	-0.433 (-0.690, -0.176)	**p<0.001**	-0.477 (-0.692, -0.166)	**p<0.05**
	Gender	2.47 (-4.28, 9.22)	p>0.05	1.452 (-5.0.39, 7.943)	p>0.05
	Type of stroke	-5.768 (-12.206, 0.669)	p>0.05	-5.827 (-12.198, 0.543)	p>0.05
	Albumin level (g/L)	1.546 (0.810, 2.282)	**p<0.001**	1.369 (0.628, 2.110)	**p<0.001**
	Admission BMI (kg/m2)	0.091 (-0.536, 0.717)	p>0.05	-1.213 (-3.497, 1.072)	p>0.05
	Discharge BMI (kg/m2)	0.218 (-0.452, 0.888)	p>0.05	1.078 (-1.381, 3.537)	p>0.05
FIM Gain	Age (years)	-0.271 (-0.428, -0.113)	**p=0.001**	-0.272 (-0.440, -0.105)	**p<0.05**
	Gender	0.165 (-3.974, 4.304)	p>0.05	-0.248 (-4.382, 3.886)	p>0.05
	Type of stroke	2.470 (-1.488, 6.428)	p>0.05	1.249 (-2.808, 5.306)	p>0.05
	Albumin level (g/L)	0.052 (-0.415, 0.518)	p>0.05	0.009 (-0.463, 0.481)	p>0.05

	Admission BMI (kg/m2)	0.055 (-0.328, 0.439)	p>0.05	0.226 (-1.229, 1.681)	p>0.05
	Discharge BMI (kg/m2)	0.060 (-0.351, 0.470)	p>0.05	-0.333 (-1.899, 1.233)	p>0.05
FIM Efficiency	Age (years)	-0.004 (-0.012, 0.004)	p>0.05	-0.002 (-0.011, 0.006)	p>0.05
	Gender	0.185 (-0.020, 0.390)	p>0.05	0.189 (-0.018, 0.397)	p>0.05
	Type of stroke	-0.051 (-0.249, 0.147)	p>0.05	-0.021 (-0.225, 0.182)	p>0.05
	Albumin level (g/L)	0.021 (-0.02, 0.044)	p>0.05	0.020 (-0.004, 0.043)	p>0.05
	Admission BMI (kg/m2)	0.003 (-0.017, 0.22)	p>0.05	-0.045 (-0.118, 0.028)	p>0.05
	Discharge BMI (kg/m2)	0.006 (-0.015, 0.026)	p>0.05	0.048 (-0.030, 0.127)	p>0.05
FIM Effectiveness	Age (years)	-0.005 (-0.008, -0.003)	**p<0.001**	-0.005 (-0.008, -0.003)	**p<0.001**
	Gender	0.357 (-0.033, 0.091)	p>0.05	0.020 (-0.040, 0.080)	p>0.05
	Type of stroke	-0.017 (-0.077, 0.042)	p>0.05	-0.031 (-0.090, 0.028)	p>0.05
	Albumin level (g/L)	0.008 (0.001, 0.015)	**p<0.05**	0.006 (-0.001, 0.013)	**p<0.05**
	Admission BMI (kg/m2)	0.001 (-0.005, 0.007)	p>0.05	-0.011 (-0.032, 0.010)	p>0.05
	Discharge BMI (kg/m2)	0.002 (-0.004, 0.008)	p>0.05	0.010 (-0.013, 0.032)	p>0.05

CI: confidence interval; FIM: functional independence measure; BMI: body mass index