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Original Article

Predicting 3-month independency using postural assessment scale for stroke in acute stroke unit: total score and item-level analysis

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Purpose: This study aimed to establish the optimal cutoff scores for the Postural Assessment Scale for Stroke (PASS) and to identify the specific PASS items at admission and discharge from an acute stroke care unit to predict independent functional status in activity of daily living (ADL) three months later. The identified cutoff scores can assist in prognosis estimation and rehabilitation goal setting, while the specific PASS items can guide task-oriented interventions in acute stroke rehabilitation.

Method: Participants were 109 individuals with acute ischemic stroke admitted to the acute care unit, all with dependence in ADL upon admission (Barthel index, BI, < 60). Data on PASS at admission and discharge were collected, with a total PASS score range of 0 to 36. Participants were categorized into independent (BI ≥ 60) or dependent (BI < 60) groups at three months post-stroke. Multivariate logistic regression analysis, with age, National Institutes of Health Stroke Scale score (NIHSS), length of acute care unit stay (LOS), admission BI as the covariates, and total PASS score as the independent variable, was performed to identify predictors of 3-month independence. In item-level analysis, each item underwent univariate logistic regression analyses, and those with significant associations were included in multivariate logistic regression analysis to determine items significantly predicting the ADL status at 3-month while controlling for confounders.

Results: On average, participants were discharged from the acute ward on day 11 after stroke onset. PASS scores at admission (OR = 1.09, 95% CI = 1.01−1.19) and discharge (OR = 1.17, 95% CI = 1.07−1.27) individually predicted ADL status at three months after stroke, with the same covariates controlled. The cutoff scores at admission and discharge were 14 (area under curve = 0.97, 95% confidence interval = 0.94 − 0.99) and 21 (area under curve = 0.99, 95% confidence interval = 0.96 − 1.00), respectively. Among all items, item 1 at admission (OR = 2.77, 95% CI = 1.42−5.39) and item 10 at discharge (OR = 4.00, 95% CI = 1.90−8.42) were significant predictors, with similar percentages correctly classifying ADL status three months post-stroke as using PASS total scores.

Conclusions: The identified total PASS scores and PASS items can assist in setting rehabilitation goals and plans, estimating prognosis, and facilitating discharge planning.

Keywords: Postural Assessment of Stroke Scale, stroke, acute care, ADL, predict validity

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1. Introduction

Rehabilitation during the acute stage (the first two weeks) after a stroke has been shown to enhance functional recovery more than interventions provided later.[1, 2] Identifying effective interventions during this early phase is crucial. A primary goal in stroke rehabilitation is restoring independent function in activities of daily living (ADL), which involves tasks requiring upright postural control. Sufficient fundamental postural control is essential before regaining independence in these activities. Task-specific functional training is recognized as a potent intervention for fostering recovery. [3] Thus, identifying postural control activities in the acute stage that correlate with targeted functional status later could provide valuable insights for effective interventions.

The Postural Assessment Scale for Stroke Patients (PASS) assesses postural maintenance, positional changes, and balance control in stroke patients. [4] Many studies have explored the correlation between PASS scores and subsequent functional recovery in the post-acute or chronic stages of stroke rehabilitation.[5-9] Trunk control, as assessed by the five PASS items in the post-acute stage, is a significant predictor of future functional recovery. [10, 11]

PASS is also recommended as an outcome measure for patients in the acute stage of stroke and for stroke research.[12] However, the relationship between PASS scores during the acute stage of stroke rehabilitation and subsequent functional recovery remains underexplored. The three-month period after a stroke is crucial for assessing functional recovery, as the majority of natural recovery occurs within the initial 3 to 6 months before reaching a plateau. [13] Determining PASS cutoff scores during acute hospitalization that can identify independent ADL three months post-stroke is significant for clinicians in assessing prognosis, establishing rehabilitation goals, and coordinating discharge plans. Additionally, identifying PASS items closely associated with ADL status three month post-stroke may streamline its clinical application and offer insights for task-specific intervention in acute rehabilitation.

The study aimed to examine the correlation between PASS scores upon admission and discharge from acute stroke rehabilitation and ADL status three month post-stroke. The specific objectives were [1] to investigate whether total PASS scores at admission and discharge individually served as significant predictors of ADL status three months post-stroke, while controlling for relevant covariates, and to report corresponding cutoff scores; and [2] to identify the most pertinent PASS items at admission and discharge associate with ADL status three months after a stroke in logistic regression analyses, controlling for the same covariates used in the multivariate analyses for the total PASS score.

2. Methods

2.1. Participants

Patients admitted to an acute stroke unit with acute stroke were sequentially screened for eligibility by a research assistant from September 2017 to July 2019. Inclusion criteria were acute ischemic stroke, age of 20 years or older, and referral from a physician (neurologist and physiatrist). Exclusion criteria included an inability to follow commands, independence in ADL at admission (Barthel index [BI] score $\geq$ 60), occurrence of adverse events (defined as any event altering the health or medical status of participants), or loss of contact during the 3-month follow-up period. Participants read and signed the institutional review board-approved informed consent form before enrollment. This study adhered to the principles outlined in the Declaration of Helsinki and received approval from the Chung Shan Medical University Hospital (CS2-16140).

2.2. Assessments

Admission and discharge assessments were conducted by a trained research assistant. Before data collection, the research assistant was trained by the first and corresponding authors and his consistency in rating BI and PASS was confirmed through assessments on multiple patients. The admission assessment, performed within 24 hours of receiving the signed consent form, included participant demographics (age and sex), cognitive function (Mini-cog test),[14] stroke severity (National Institutes of Health Stroke Scale, NIHSS),[15] days since stroke onset at admission, days since stroke onset at the start

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of rehabilitation, and length of stay at the acute care unit. PASS and BI assessments were also conducted at admission. The discharge assessment, including PASS and BI evaluations, was completed within 24 hours before the scheduled discharge date. The discharge destination for post-acute rehabilitation (out-patient or in-patient) was also recorded. At 3 months post-stroke, participants' ADL functional status was assessed with BI, and they reported admission and discharge dates and dose (days of rehabilitation per week and daily duration of rehabilitation) of their post-acute rehabilitation.

The total PASS score ranges from 0 to 36, with lower scores indicating poorer postural performance.[4] The PASS demonstrates excellent internal consistency (Cronbach $\alpha = 0.95$), test-retest reliability (kappa = 0.72), and interrater reliability (kappa = 0.88).[4] The BI assesses participants' level of dependence in ADL based on their performance on 10 basic ADL items. BI scores range from 0 to 100, with lower scores indicating poorer ADL function.[16] The BI exhibits well-established reliability and validity, making it recommended for measuring ADL function in stroke patients.[16, 17] The internal consistency of the BI is high (Cronbach $\alpha = 0.90$)[16] and test-retest reliability is also high (ICC = 0.94).[17] After three months of follow-up, participants' ADL functional status was assessed with BI and classified into an independent group ($BI \geq 60$) and a dependent group ($BI < 60$). A BI score of 60 is considered a critical threshold for a patient to transition from dependency to assisted independence, and a score above 60 indicates a favorable outcome, such as a shorter length of stay.[18] Conversely, a BI score of 60 or below corresponds to a modified Rankin scale above 3, signifying a poor outcome and severe disability.[19]

2.3. Data Analysis

Descriptive statistics of participants' characteristics are reported for the entire group and separately for the ADL independent and dependent groups at three months post-stroke. Differences in characteristics between groups were examined using the independent t-test for normally distributed variables, the Mann–Whitney U test for skewed variables, and the chi-square test for categorical variables, with a significance level of 0.05.

To examine whether PASS scores at admission and discharge were significant predictors of ADL status three months after stroke, we first explored their association in a univariate logistic regression analysis. The one significantly associated with ADL status three months later was further investigated in multivariate logistic regression, where ADL status at three months post-stroke was the dependent variable, coded as 1 for independence and 0 for dependence. Characteristics of participants exhibiting significant group differences were potential confounders and covariates in the multivariate logistic regression analysis.

Receiver Operating Characteristic analysis was employed to determine the optimal cutoff score (yielding the maximum sum of sensitivity and specificity) of the PASS at admission and discharge for identifying independent ADL status three months after stroke, while controlling for the same covariates in the logistic regression. An area under the curve of ≥ 0.7 was considered acceptable discriminant validity.[20]

To identify the PASS items most strongly associated with the status of ADL three months after stroke, we assessed the association of each PASS item with ADL status using univariate logistic regression with the same covariates included in the previous logistic regression controlled for. Items demonstrating a significant association were entered into the multivariate logistic regression with the same covariates controlled for, using wald forward selection, to identify the most significant predictor of the ADL status at three months post-stroke.

3. Results

A total of 168 participants initially enrolled, but 47 were excluded due to a BI score ≥ 60 at admission. Additionally, 12 more were excluded during the three-month follow-up for various reasons: eight experienced a fall and rehospitalization, one had a recurrent stroke, and three lost contact. Consequently, data from109 individuals meeting the study criteria were used, with 81 (74.3%) in the independent group and 28 (25.7%) in the dependent group. Both groups were similar in terms of sex, impaired cognition (Mini-Cog test ≤ 3) at admission, days since onset at

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Table 1. Characteristics of participants

	Total (n=109)	ADL Independent group at 3M (n=81)	ADL Dependent group at 3M (n=28)	*P value*
Age, years, mean (standard deviation) †	69.1 (12.8)	67.4 (13.3)	74.0 (9.7)	0.02
≤ 64, n (%)	39 (35.8%)	34 (42.0%)	5 (17.9%)	0.02
≥ 65, n (%)	70 (64.2%)	47 (58.0%)	23 (82.1%)	
Sex (men), n (%)	70 (64.2%)	53 (65.4%)	17 (60.7%)	0.65
NIHSS, score ‡	6 (4, 9)	5 (4, 8)	8 (6, 14)	0.02
Mild (0~4)	36 (33%)	31 (38.3%)	5 (17.9%)	0.03
Moderate (5~15)	67 (61.5%)	47 (58.0%)	20 (71.4%)	
Severe (≥ 16)	6 (5.5%)	3 (3.7%)	3 (10.7%)	
Mini-Cog test (impaired, ≤ 3 points), n (%)	86 (78.9%)	62 (76.5%)	24 (85.7%)	0.31
Admission (days post-onset) ‡	1 (0, 2)	1 (0, 2)	1 (0, 2)	0.35
Rehabilitation initial (days post-onset) ‡	4 (3, 6)	4 (3, 6)	4 (4, 6)	0.06
Discharge (days post-onset) ‡	11 (8, 15)	10 (8, 14)	14 (8, 16)	0.05
Length of stay, days ‡	9 (7, 13)	9 (7, 12)	13 (7, 15)	0.03
Admission BI, score ‡	30 (20, 45)	40 (25, 50)	18 (10, 25)	< 0.0001
Admission PASS, score ‡	23 (15, 29)	25 (18, 29)	12 (7, 21)	< 0.0001
Discharge PASS, score ‡	30 (21, 33)	32 (27, 34)	17 (10, 26)	< 0.0001

Values in table represent median (inter-quartile range) unless otherwise indicated
NIHSS: National Institutes of Health Stroke Scale; BI: Barthel index; PASS: Postural Assessment Scale for Stroke; 3M: three months post-stroke
†: independent t-test ‡: Mann-Whitney U test

admission, and days since onset at discharge (Table 1). On average, participants were discharged from the acute care unit on day 11 after stroke onset. Our participants' NIHSS scores ranged from 0 to 22, with the majority having moderate stroke severity (NIHSS = 5-15, 61.5%), followed by mild stroke severity (NIHSS = 0-4, 33.0%). A minority had severe stroke (NIHSS ≥ 16, 5.5%). The dependent group was characterized by older age, greater stroke severity (NIHSS), longer acute care unit stay, lower BI and PASS scores at admission, and lower PASS scores at discharge from the acute unit (Table 1). Similar percentages of participants were discharged to outpatient post-acute rehabilitation (independent group 40.7%, dependent group 35.7%) and inpatient post-acute rehabilitation (independent group 59.3%, dependent group 64.3%) ($\chi^2_{(1)} = 0.22$, $p = 0.64$). The average post-acute rehabilitation days were comparable in the independent (34.3 days) and dependent (38.4 days) groups.

3.1. PASS total scores at admission and discharge were significantly associated with ADL status 3-month after stroke

In the univariate analysis, the PASS scores at admission ($\gamma_s = -0.46$, $p < 0.0001$) and discharge ($\gamma_s = -0.53$, $p < 0.0001$) exhibited a moderate association with ADL status three months after stroke. In the logistic regression analysis, with control for age, NIHSS score, length of acute care unit stay, and BI scores at admission, PASS scores at admission (OR = 1.09, 95% confidence interval = 1.01–1.19)

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Table 2. Results of logistic regression

	Logistic regression 1 (PASS admission)			Logistic regression 2 (PASS discharge)		
	B	OR (95% CI)	*P value*	B	OR (95% CI)	*P value*
Age	-0.04	0.96 (0.92−1.01)	0.15	-0.02	0.98 (0.93−1.04)	0.49
NIHSS	-0.07	0.94 (0.82−1.07)	0.32	-0.02	0.98 (0.84−1.15)	0.80
LOS	-0.09	0.92 (0.80−1.04)	0.19	-0.06	0.94 (0.82−1.08)	0.40
Admission BI	0.03	1.03 (0.98−1.08)	0.28	0.03	1.03 (0.98−1.08)	0.27
Admission PASS	0.09	1.09 (1.01−1.19)	0.03			
Discharge PASS				0.15	1.17 (1.07−1.27)	< 0.0001
Omnibus test for model	$\chi^2_{(5)} = 35.53$, $p < 0.0001$			$\chi^2_{(5)} = 46.29$, $p < 0.0001$		
Nagelkerke R^2	0.41			0.51		
Hosmer & Lemeshow test	$\chi^2_{(8)} = 6.36$, $p = 0.61$			$\chi 2^2_{(8)} = 8.91$, $p = 0.35$		
Correct classification %	80.7%			88.1%		

NIHSS: National Institutes of Health Stroke Scale; LOS: length of stay; BI: Barthel index; PASS: Postural Assessment Scale for Stroke

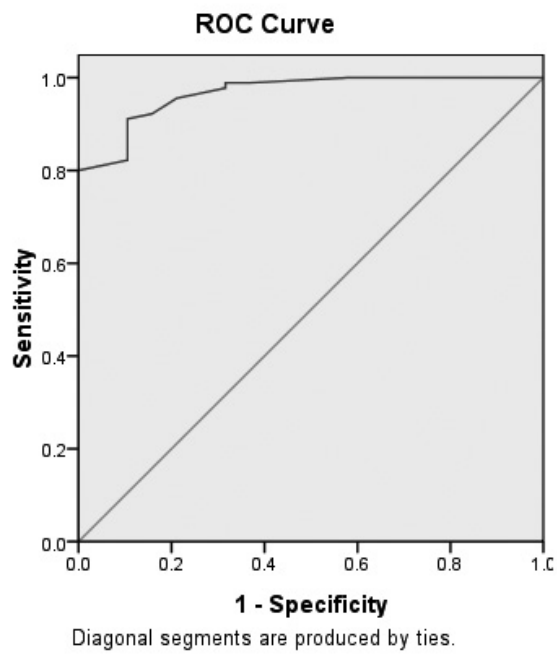
Table 3. Results of receiver operating curve (ROC) analysis

	AUC (95% CI)	Cutoff value	Sensitivity (%)	Specificity (%)
PASS admission	0.97 (0.94−1.00)	13.5	91.1	89.5
PASS discharge	0.99 (0.96−1.00)	20.5	95.3	100.0

PASS: Postural Assessment Scale for Stroke; AUC: area under the curve; CI: confidence interval

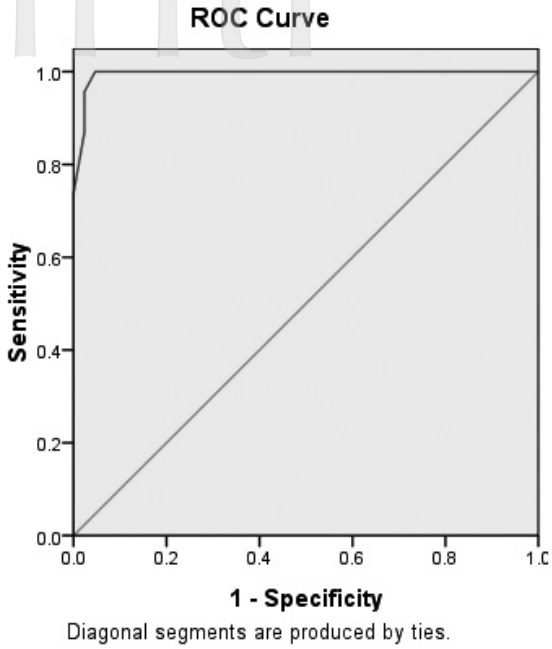
and discharge (OR = 1.17, 95% confidence interval = 1.07–1.27) remained significantly associated with ADL status three months after stroke (Table 2). The overall fit of the model was significant ($p < 0.0001$), and the result of the Hosmer−Lemeshow goodness-of-fit was not significant ($p > 0.05$), indicating a good fit for the model. The model could explain 41% and 51% of the variance (Nagelkerke R^2) in the ADL status three months after stroke, with an accuracy of 80.7% and 88.1% for the total PASS scores at admission and discharge, respectively.

The optimal cutoff scores for PASS total scores at admission and discharge to identify the ADL independent group from the dependent group three months after stroke were determined to be 13.5 (sensitivity, 91.1%; specificity, 89.5%) and 20.5 (sensitivity, 95.3%; specificity, 100.0%), respectively (Table 3). The area under the curve for PASS scores at admission and discharge was 0.97 (95% confidence



(A) Admission

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(B) Discharge

Figure. Receiver operating curve for PASS total scores at admission (A) and at discharge (B) in predicting the independent status of activities of daily living three months after stroke

interval = 0.94–0.99) and 0.99 (95% confidence interval = 0.96−1.00), respectively, indicating satisfactory discriminative ability (Figure).

3.2. Specific PASS items at admission and discharge associated with ADL status 3-month after stroke

The results of univariate logistic regression indicated that four items at admission (items 1, 2, 3, and 10) and 9 items at discharge (items 2, 3, 4, 7, 8, 9, 10, 11, and 12) significantly associated with 3-month ADL status (Table 4). These significant items identified from the univariates logistic regression were entered into the multivariate logistic regression analysis, over and above the same covariates. The majority of the dependent group (90.8%) and 100% of the independent group achieved the highest score (score 3) on item 1 at discharge; thus the odds ratio (OR) for item 1 in the univariate regression analysis could not be estimated. The results of multivariate logistic regression demonstrated that item 1 at admission and item 10 at discharge were significant

Table 4. Univariate logistic regression analysis for item-level analysis

	PASS at admission		PASS at discharge	
PASS items	B	OR (95%CI)†	B	OR (95%CI)†
1 (sitting without support)	1.01**	2.8 (1.4-5.4)	19.62	3.31E8
2 (standing with support)	0.58*	1.8 (1.1-2.9)	1.55**	4.7 (1.8-12.3)
3 (standing without support)	0.60*	1.8 (1.1-3.1)	0.69**	2.0 (1.3-3.1)
4 (standing on non-paretic leg)	0.34	1.4 (0.8-2.5)	0.63**	1.9 (1.2-2.9)
5 (standing on paretic leg)	0.04	1.0 (0.5-2.1)	0.38	1.5 (0.9-2.4)
6 (supine to paretic)	0.49	1.6 (0.6-4.1)	0.34	1.4 (0.4-5.3)
7 (supine to non-paretic)	0.41	1.5 (0.8-2.9)	1.12*	3.1 (1.0-9.4)
8 (supine to sitting)	0.41	1.5 (0.7-3.2)	1.21**	3.4 (1.5-7.4)
9 (sitting to supine)	0.04	1.0 (0.5-2.0)	1.24**	3.4 (1.5-8.0)
10 (sitting to standing up)	0.79*	2.2 (1.0-4.7)	1.39***	4.0 (1.9-8.4)
11 (standing up to sitting)	0.51	1.7 (0.9-3.0)	1.37**	3.9 (1.8-8.6)
12 (Standing, picking up pencil)	0.28	1.3 (0.6-3.1)	0.75*	2.1 (1.2-3.8)

*p<0.05 **p<0.01 ***p<0.0001

PASS: Postural Assessment Scale for Stroke; B: coefficient (β) the mathematical weighting of each variable in the model; OR: odds ratio; CI: confidence interval

†: controlling for other variables (age, National Institutes of Health Stroke Scale score, length of acute care unit stay, Barthel index score at admission)

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predictors of 3-month ADL status (Table 5).

4. Discussion

Our study indicates that PASS total scores at admission and discharge in the acute stage serve as significant predictors of ADL status three months after stroke, even when controlling for covariates. Cutoff scores of 14 at admission and 21 at discharge can be utilized to predict the prognosis of independent ADL status three months after stroke. Furthermore, specific PASS items identified as significantly associated with ADL status three months after stroke could inform task-specific interventions.

The study suggests that the discharge total PASS score (around 10-14 days post-onset) is a stronger predictor of 3-month ADL independence compared to the admission score. This is likely because, during admission to the acute stroke care unit, patients are typically weak and medically unstable, resulting in a weaker association between PASS and the target outcome. As patients progress in recovery, regain more control over postural functions, and approach the three-month post-stroke period, the PASS score at discharge exhibits a stronger association with the outcome.

Our results align with previous studies conducted in inpatient rehabilitation settings during the post-

Table 5. Multivariate logistic regression analysis for item-level analysis

Logistic regression 1 (PASS admission)				Logistic regression 2 (PASS discharge)			
	B	OR (95% CI)	*P value*		B	OR (95% CI)	*P value*
Age	-0.04	0.96 (0.91−1.01)	0.11	Age	-0.02	0.98 (0.93−1.04)	0.49
NIHSS score	-0.04	0.96 (0.84−1.10)	0.57	NIHSS score	-0.002	1.00 (0.85−1.17)	0.98
LOS	-0.08	0.93 (0.81−1.06)	0.27	LOS	-0.09	0.91 (0.79−1.05)	0.21
Admission BI	0.03	1.02 (0.97−1.07)	0.14	Admission BI	0.03	1.03 (0.99−1.08)	0.19
PASS 1	1.02	2.77 (1.42−5.39)	0.003	PASS 2			
PASS 2				PASS 3			
PASS 3				PASS 4			
PASS 10				PASS 7			
				PASS 8			
				PASS 9			
				PASS 10	1.39	4.00 (1.90−8.42)	<0.0001
				PASS 11			
				PASS 12			
Omnibus test for model	$\chi^2_{(5)} = 41.29$, $p < 0.0001$			Omnibus test for model	$\chi^2_{(5)} = 47.76$, $p < 0.0001$		
Nagelkerke R^2	0.46			Nagelkerke R^2	0.52		
Hosmer & Lemeshow test	$\chi^2_{(8)} = 9.57$, $p = 0.30$			Hosmer & Lemeshow test	$\chi^2_{(8)} = 10.39$, $p = 0.24$		
Correct classification %	84.4%			Correct classification %	82.6%		

NIHSS: National Institutes of Health Stroke Scale; LOS: length of acute care unit stay; BI: Barthel index; PASS: Postural Assessment Scale for Stroke; B: coefficient (β) the mathematical weighting of each variable in the model; OR: odds ratio; CI: confidence interval

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acute stage (14 days or later after stroke), highlighting the predictive ability of PASS total scores for future functional recovery.[6-10] Unlike earlier studies, our investigation specifically focused on PASS performance within the acute stage (within 14 days after onset) of stroke rehabilitation. There is scarcity of comparable studies on acute stroke rehabilitation. Our results are in concordance with a prior acute-phase study demonstrating that trunk control within 48 hours of acute stroke onset, assessed with the Trunk Impairment Scale, served as an early predictor of ADL performance at acute unit discharge.[21]

The study results reveal that acute stroke patients with admission and discharge PASS scores of 14 and 21 or more were more likely to regain ADL independence three months after a stroke. These cutoff scores are consistent with those reported in previous studies during the acute stage.[22, 23] In one study involving acute stroke patients unable to walk independently at admission, it was found that patients with a discharge PASS total score ≥ 22 were more likely to regain independent walking three months post-stroke.[22] Another study, including acute stroke patients unable to walk at their preferred walking speed on admission, demonstrated that patients with a discharge PASS total score ≥ 20.5 were more likely to achieve a walking speed ≥ 0.8 or ≥ 1 m/s six months post-stroke.[23] The similarity between our discharge cutoff score and previous studies in identifying independent walking or community-level walking speed (≥ 0.8 m/s) may be attributed to the BI, which includes items assessing similar abilities, such as waking 50 m or more and managing stairs. Additionally, our study reports the PASS cutoff score at admission. Knowledge of a patient's ADL prognosis three months after stroke at admission can assist clinicians in setting individualized goals and allocating medical resources during the acute phase. The PASS cutoff scores at discharge can serve as a goal for acute rehabilitation and help clinicians estimate the prognosis of ADL status three months after stroke when planning discharge.

Our study differs from past research by exploring the specific PASS items associated with ADL status three months after stroke. The predicting ADL status three months post-stroke with comparable or better accuracy can be achieved by using item 1 (sitting without support) alone at admission, and item 10 (sitting to standing up) at discharge. Emphasizing these tasks during acute-stage rehabilitation is recommended.

Contrary to previous findings, our results did not suggest a high association between supine-to-paretic/non-paretic side movements and ADL functional status three months after stroke. These two items are part of the five trunk control PASS items reported in a previous study.[10] In fact, the majority of our participants achieved the highest score on supine-to-paretic side (80.7%) or the non-paretic side (64.2%) upon admission, and these percentages increased to 90.8% and 82.6% at discharge, respectively. Advances in emergency care protocol for acute ischemic stroke may contribute to reduced severe functional impairment and stroke severity, resulting in diverse outcomes.

This study introduces three novel findings: establishing the association between PASS during acute-stage rehabilitation and ADL status three months after a stroke, providing reported cutoff scores for PASS in the acute phase, and identifying items most closely related to independent ADL status three months after a stroke. While the findings of this study can be applicable to patients with characteristics similar to our participants, such as acute ischemic stroke, mild to moderate stroke severity, BI < 60 on admission, predominantly aged over 65 years, initiated rehabilitation approximately four days post-onset, and an average stay in the acute care unit for nine days, validation through larger prospective studies is essential. A study group with participants exhibiting more severe stroke severity may reveal the most fundamental postural changing items in the PASS (such as rolling to paretic / non-paretic side) as significant predictors of ADL status three months post-stroke.

5. Conclusions

Performance on the PASS at admission and discharge during the acute stage of stroke rehabilitation predicts ADL status three months after onset. Patients with acute ischemic stroke achieving PASS scores of ≥ 14 or ≥ 21 on admission and discharge, respectively, are more likely to regain

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independent in ADL three months after s stroke. These specified cutoff scores serve as valuable tools for clinicians to estimate the three months post-stroke prognosis when planning discharge. In the acute stage of stroke rehabilitation, items 1 and 10 (sitting without support, sitting to standing up) show a close association with ADL status three months after a stroke and are recommended for use in acute rehabilitation interventions.

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The authors report that there are no competing interests to declare.

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