

Predictive Factors of Functional Outcome after Acute Stroke in Emergency Department

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Abstract

Introduction: Acute stroke (AS) is the third most common cause of disability in adults. Identifying predictive factors of its functional prognosis is necessary to accurate prediction of patient outcomes.

Aim of the Study: The aim of our study was to identify significant predictors of poor functional outcome in patients presenting with AS to the emergency department (ED).

Methods: Prospective monocentric study conducted over six years and six months. Inclusion of all adults patients admitted to the ED with symptoms of AS. Clinical, anamnestic, demographic and radiological characteristics were recorded. Use of the National Institutes of Health Stroke Scale (NIHSS) and Rankin modified score (mRS). Functional prognosis was evaluated at 3 months after the acute episode with the mRS. Severe disability was considered if mRS = 4 or 5. We proceeded to a comparative analysis between two groups: patients with severe disability (mRS = 4 or 5) versus patients with mild to moderate disability (mRS ≤ 3).

Results: Inclusion of 232 patients. Mean age = 67 ±13 years. Sex ratio = 1.41. Two hundred and two patients (87%) were totally independent before the acute episode (mRS ≤ 2). After 3 months, 18% of patients were severely impaired. Independent risk factors associated with this severe disability were: age ≥ 70 years (adjusted OR = 1.49, 95%CI: 1.11 - 2.19), NIHSS score ≥ 11 (adjusted OR = 1.86, 95%CI: 1.23 - 2.81) and GCS ≤ 11 (adjusted OR = 1.57, 95%CI: 1.13 - 2.56).

Conclusion: Early identification, from the ED, of predictive factors of functional outcome of AS may improve patients' later functional independence level.

Keywords: Acute Stroke; Prognosis; Emergency Department; Functional Outcome; Disability

Abbreviations

AS: Acute Stroke; ED: Emergency Department; FAST: Face-Arms-Speech-Time; h: Hours; NIHSS: National Institutes of Health Stroke Scale; mRS: modified Rankin Scale; GCS: Glasgow Coma Scale; CI: Confidence Interval; OR: Odds Ratio; rTPA: recombinant Tissue Plasminogen Activator; D90: Day 90

Introduction

Stroke is the second leading cause of death worldwide and the leading cause of major long term disability among adults [1]. Previous prognostic studies about AS have focused mainly on the prediction of mortality; however functional outcomes, which are measured by

disability and individual’s loss of independence in activities of daily living, are considered to be among the most meaningful patient outcomes. Many predictive factors of functional outcome of AS had been identified these thirty years.

In Tunisia, AS is a frequent medical emergency seen in our EDs which leads to hospitalization [2].

Nevertheless, functional status is not measured consistently outside of post-acute rehabilitation services, nor is assessed using a common and comparable measure.

Few studies have studied functional outcomes and have been published from the EDs.

Aim of the Study

The aim of our study was to identify predictive factors of poor functional outcome in patients admitted to the ED with AS.

Materials and Methods

We conducted a prospective observational study during six years and six months in the ED of the regional hospital of Ben Arous city, next to Tunis, the capital of Tunisia.

The ED had approximately 70 000 patient visits per year, of which 600 patients (0.12%) had neurologic symptoms evocative of AS. The hospital does have neither a co-located computerized tomography (CT scanner) nor a neurologic department.

We enrolled all adult patients admitted to the ED with a brutal onset systemized focal weakness.

We didn’t include patients which neurological symptoms were due to:

- Metabolic causes (hypoglycemia, hyponatremia...)
- Traumatic causes
- Toxic causes (CO poisoning)
- Psychiatric causes (conversion disorder).

Also, no reachable phone number and unavailability of CT-scanner were among non-inclusion criteria.

Were excluded from the study, patients which the final diagnosis was transient ischemic attack or not an AS (brain metastasis, cerebral thrombophlebitis...).

The figure 1 shows the study design.

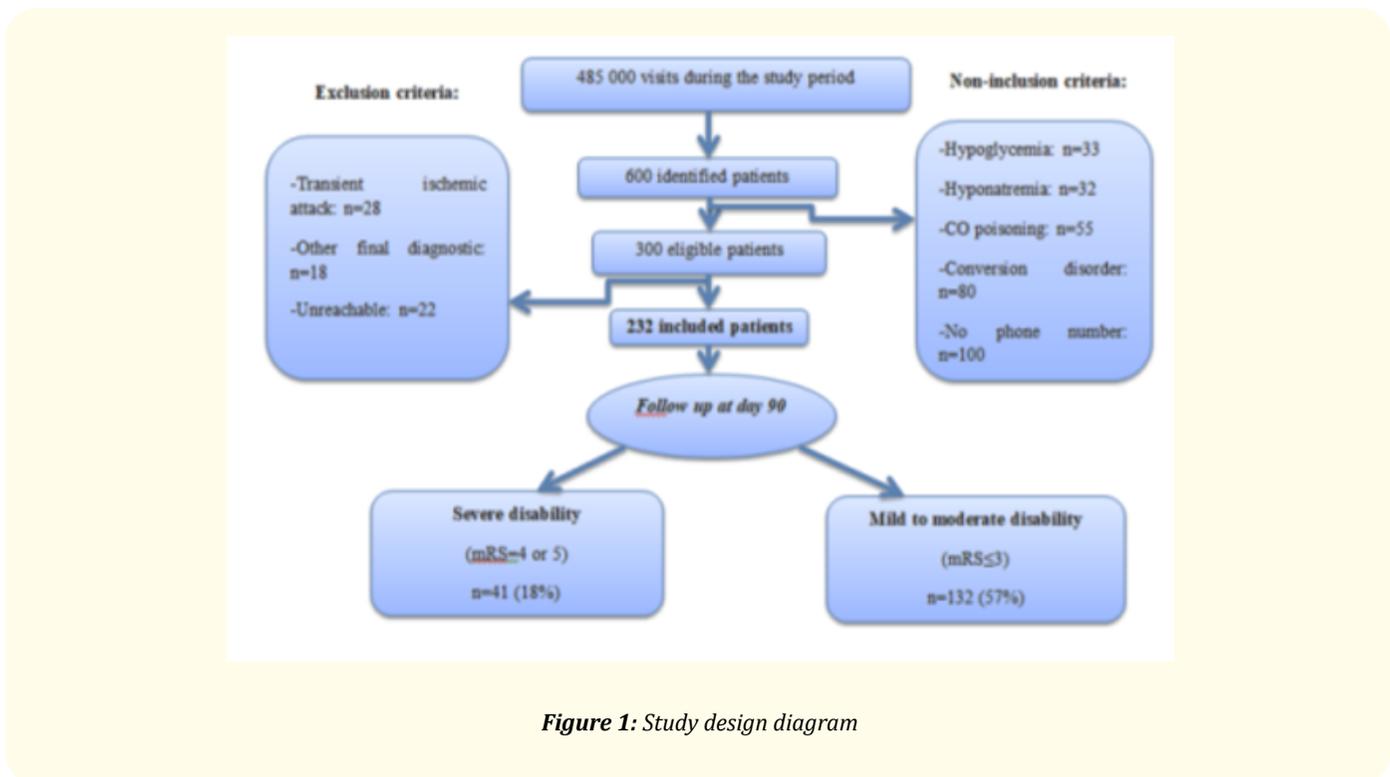


Figure 1: Study design diagram

Collected data included demographics features, chief of complaints evaluated by the acronym FAST, means used in home to hospital transfers, different delays (symptom onset to admission to the ED, symptom onset to brain imaging and admission to the ED to brain imaging times), comorbidities, physical examination, laboratory data, radiological data, treatment at the ED or wards and final destination.

Different scores were assessed:

- AS recognition by using the acronym FAST (Face-Arms Speech-Time).
- Level of consciousness at admission by using the Glasgow Coma Scale (GCS).
- Stroke severity according to the degree of neurologic impairment by using the National Institutes of Health Stroke Scale (NIHSS).
- Functional status by using the modified Rankin Scale (mRS).

Patients were followed during three months. They were contacted by phone.

The primary outcome was the presence of unfavourable functional consequences three months (day 90) after AS, as reflected by mRS = 4 or 5.

We subdivided the cohort according to the functional impairment into two groups: patients with severe disability (mRS = 4 or 5) versus patients with mild to moderate disability (mRS \leq 3).

Data were analyzed by using SPSS 20.0. Categorical data were described by frequency and percentages. Continuous data were summarized by their mean and standard deviation. Comparisons were assessed by using the analysis of variance, Student t test, or Wilcoxon test for continuous variables and the chi-squared or Fisher exact test for categorical variables.

Analysis of predictive factors of poor functional outcome at day 90 (D90) was performed initially by using a univariate analysis. Multivariate analysis was performed by logistic regression. A multiple logistic regression model was used to assess the relationships between predictors of functional disability by all causes.

Differences were considered to be statistically significant with $p < 0.05$ or when the 95% confidence interval (CI) of the odds ratio (OR) excluded the value of 1.

Results and Discussion

We included 232 patients. Mean age was 67 ± 13 years. Sex-ratio = 1.41.

The principal mean of home to hospital transfers was private transportation for 89.2% of patients.

The chief of complaints was the focal neurologic weakness evaluated by FAST noticed in 76.3%.

An initial coma with a GCS \leq 8 was recorded for 16 patients (7%). Two hundred and two patients (87%) were totally independent before the accurate episode with a mRS \leq 2. The mean NIHSS was 9 ± 6 .

The median delays of symptom onset to admission to the ED, symptom onset to brain imaging and admission to the ED to brain imaging times, were respectively 6 hours (h) and 20 minutes, 15h and 4h.

One hundred and sixty patients (69%) arrived to the ED within four hours and a half and 57% have consulted before the third hour from symptoms onset.

Comorbidities were n (%): hypertension 151 (65), diabetes 83 (35.8), history of AS 68 (29.3), dyslipidemia 48 (20.7) and atrial fibrillation 30 (13).

All patients had a CT scanner. An acute ischemic stroke was recorded for 74% of patients and the infarction was in the middle cerebral artery territory in 39% of cases.

Table 1 shows radiological data of the population.

CT scan results	N (%)
Black core	164 (71)
Middle cerebral artery	64 (39)
Vertebral artery	45 (27)
Anterior cerebral artery	20 (12)
Others	35 (21)
Intra-parenchymal hemorrhage	53 (23)
Cerebral trunk	10 (4)
Lobar	4 (1.6)
Capsulo lenticular	3 (1.4)
Capsulo thalamic	2 (0.8)

Table 1: Radiological data from brain imaging.

In the ED, non-specific administered treatments were n (%): subcutaneous insulin therapy 52 (22), non-invasive oxygen therapy 15 (6.5), orotracheal intubation 14 (6) and anticonvulsant therapy 10 (4).

The main factor limiting the use of thrombolytic agents for ischemic stroke is the three-hour window of administration of recombinant tissue plasminogen activator (rTPA).

In fact, 57% of patients arrived before the third hour from symptom onset, 37% of patients had the neurovascular plan activated after eliminating the contraindications, 22% of patients had the brain imaging within three hours, 13% of patients were eligible to reperfusion therapy administration and only three patients were reperfused successfully.

Patients were hospitalized in only 41% of cases: in neurologic department (45%), neurovascular unit (20%) and stayed in the ED (24%).

For the follow up at D90, we assessed the degree of functional impairment by using the mRS: severe disability defined if mRS = 4 or 5 and mild to moderate disability if mRS ≤ 3.

The mortality at D90 was 25%.

The functional status is shown in figure 2.

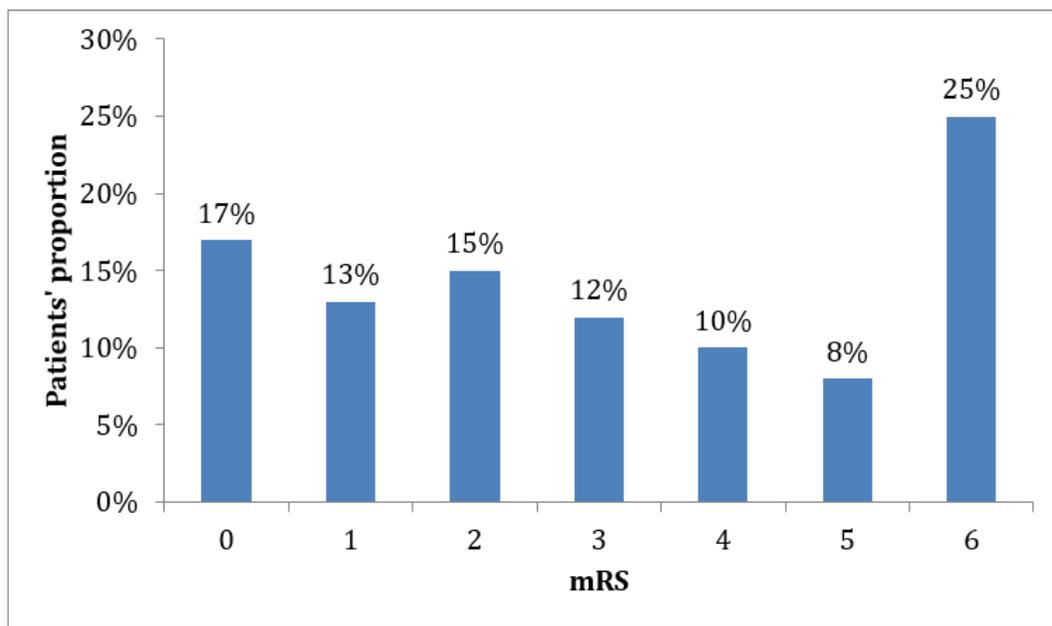


Figure 2: Functional status at D90.

Patients with severe disability (n = 41) were compared to patients with mild to moderate disability (n = 132).

The comparison between the two groups is shown in table 2.

Factors	mRS = 4 or 5 n = 41	mRS ≤ 3 n = 132	P
Mean age ± SD (years)	70 ± 14	64 ± 12	0.006
Mean NIHSS ± SD	11 ± 5	6 ± 5	< 0.001
Mean GCS ± SD	12 ± 2	14 ± 1	< 0.001
Delay of secondary transfer ≥ 60 min n (%)	27 (66)	58 (44)	0.01
Secondary transfer by EMS n (%)	13 (32)	21 (16)	0.02

Table 2: Comparison between patients with severe disability and those with mild to moderate disability.

The independent predictive factors of severe functional outcome revealed by the multivariate analysis are resumed in table 3.

Factors	Adjusted OR	IC95%	P
Age ≥ 70 years old	1.49	[1.11 - 2.19]	0.04
NIHSS ≥ 11	1.86	[1.23 - 2.81]	0.003
GCS ≤ 11	1.57	[1.13 - 2.56]	0.04

Table 3: Independent predictive factors in multivariate.

The recent statistic results shows that AS is the first cause of non-traumatic functional impairment in adults and the third cause of death after cardiovascular diseases and neoplasms [3].

In high-income countries, AS causes 30% of permanent functional impairment with severe disability [4,5]. Patients having AS were at a higher risk of recurrence in days or weeks after the first episode.

A deep understanding of the most important factors that may have an impact on the prognosis of this condition is necessary for accurate prediction of patient outcomes, for providing a rational approach to the clinical and therapeutic management, as well as for assisting patients and families to better understand the challenging consequences of cerebral ischemia [6].

In our study, we included 232 patients. The population was rather young. Patients arrived to the ED by using their private transportation in 89%. Cardiovascular diseases are often associated to the occurrence of AS; the leader was hypertension (65%), second diabetes (35.8%), and then history of AS (29.3%).

The focal neurologic weakness was the chief of complaints (76.3%) with a median delay of symptoms onset to admission time about 6 hours and 20 minutes.

Patients who arrived to the ED before the third hour from symptoms onset were 57%.

The mean NIHSS and GCS at admission were respectively 9 ± 6 and 13 ± 2 .

After the brain imaging, the type of AS was ischemic in 74% and hemorrhagic in 23% of patients. The median delay of symptoms onset to brain imaging time was 15 hours.

The final destination was a hospitalization for 41% of patients although 69% of them were returned home.

At D90, a severe disability was noticed in 18% of patients. Three factors were independently associated with poor functional outcome: age more than 70 years old, NIHSS more than 11 and GCS less than 11.

Before discussing our results, we need to point out some limits of our study.

First it was a monocentric study conducted in an ED of a regional hospital without neurologic department nor a co-located CT-scanner.

Second, it would be more accurate to study other complications after AS such as urinary dysfunction and cognitive impairment which can influence the functional status.

Third, specify the role of rehabilitation in the gain of functional independence.

Many other studies concluded to the same factors identified in our study as predictive factors of poor functional outcome after AS.

A Korean study published in 2016 had identified, in univariate analysis at 6 months after episode; advanced age, high NIHSS, low GCS, long length of stay and the functional status at discharge as predictive factors of severe functional disability [7].

Damak, *et al.* [8] identified the same factors at one month, with also the anterior functional status, history of stroke, seizures onset and ischemic stroke.

Otherwise, an American study published in 2015 in the “North American Solitaire Stent Retriever Acute Stroke (NASA)” registry, identified in a multivariate analysis an age more than 80 years old, a NIHSS more than 18 and a non-administration of a reperfusion therapy as independent predictive factors of mortality and functional disability at one month [9].

Our study, offer the opportunity to identify earlier patients with higher risk of severe functional impairment after the onset of stroke symptoms who will necessitate more aggressive management in qualified neurovascular units according to scientific guidelines.

Developing a model based on the integration of these clinical parameters and more biological ones to enhance prognosis after AS is a challenging project for the future.

Conclusion

Acute stroke is an epidemic neuro vascular disease with high economic cost and high risk of morbi-mortality. The availability of prediction tools enabling an efficient risk stratification of patients after the onset of stroke would hence be regarded as a valuable perspective for identifying those patients who need specific and more aggressive management in order to improve their quality of life after an episode of stroke.

Conflict of Interest

The authors declare that they have no competing interests.

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