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Evaluation of an early discharge strategy from neurovascular intensive care unit after IV thrombolysis of ischemic strokes at "La Pitie Salpetriere" cerebrovascular emergency department

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ABSTRACT

Strokes are common and represent a major public health concern in both industrialized countries and developing countries. Patient management must prevent overcrowding of intensive care beds and downstream bed capacity.

The aim of the study was to propose an early discharge strategy from the stroke unit after IV thrombolysis, based primarily on the NIHSS score. This is a retrospective study involving 617 patients admitted to the neurovascular unit the "Pitié-Salpêtrière" hospital for ischemic stroke, divided into two cohorts, March 2010 and August 2012.

The patients were divided into 4 classes according to the NIHSS score: Class A, B, C, and D. They were clinically assessed on day 1 and day 7, considering as a criterion for worsening the transition from a lower to a higher class.

Patients in classes A and D who were candidates for early discharge worsened less than patients in classes B and C. This study demonstrated that it is indeed possible to stratify patients using the NIHSS score as early as 24 hours after IV thrombolysis into groups at high risk of deterioration and groups at lower risk of deterioration. The least severe patients in class A and the most severe in class D could be discharged 24 hours after thrombolysis, while those in classes B and C needed to stay in neurovascular ICU unit for more than 24 hours.

This stratification at the early discharge from neurovascular ICU, if implemented, could have a positive impact on the organization of ICU, especially in low-income countries.

Keywords: Stroke; IV thrombolysis; Neurovascular unit; Neurovascular; ICU

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INTRODUCTION

Strokes are common and serious; in industrialized countries, they are the leading cause of acquired disability in adults and the second leading cause of death [1].

In Neurology Departments in sub-Saharan Africa, they account for 30 to 50% of admissions and are the leading cause of morbidity and mortality [2].

All the recommendations regarding their management published in France [3,4], in Europe [5], and in the USA [6] emphasize that an improvement in prognosis is only possible when care is organized within a specialized and structured pathway from the site of the event to the return home. This involves, on one hand, the creation of neurovascular units and, on the other hand, the organization of the entire upstream and downstream care pathway.

The concept of the stroke unit emerged in the 1970's, with the goal of stroke unit treatment being not only to reduce mortality but also to decrease disability and the risk of institutionalization. Stroke care in a stroke unit significantly reduces the risk of death by 18%, death or institutionalization by 19%, and death or dependency by 21% compared to conventional care outside of any thrombolysis [7].

The benefit of neurovascular lasts up to 5 and even 10 years after a stroke, thus patients who survive because of the appropriate management at the neurovascular do not have an increased risk of recurrence or long-term disability [7]. neurovascular units are specialized pathways capable of managing acute stroke; they are structured into neurovascular intensive care units and subacute care units.

Intensive care is the unit where patients requiring intensive, neurological, and hemodynamic monitoring are managed for 24 hours a day. It is in this part of the ICU that fibrinolytic treatments are administered; the stroke-dedicated beds or subacute care beds, geographically grouped, provide standardized and specialized care for strokes that do not require or no longer require intensive monitoring [3].

The management of strokes in a stroke unit optimizes patient care and helps prevent death in 33 cases, institutionalization in 20 cases and dependency in 20 [3,8].

Currently, emergency treatment of ischemic stroke is carried out in a neurovascular ICU and involves IV thrombolysis. rt-PA is the only treatment proven effective in the acute phase. It allows for a 14% reduction in stroke mortality, and 30-50% of patients have little to no disability at 3 months [3,4,9].

The stay length in the neurovascular is usually between 24 and 72 hours, sometimes even 5 days, and is not based on any specific recommendation; it depends on the experience of each team and the capacity of the units.

The effective implementation of thrombolysis requires the permanent availability of beds in the intensive neurological care unit. This availability depends on the clinical condition of the thrombolyzed patients, the congestion of beds in the subacute care unit, and also the availability of spot in functional rehabilitation.

It therefore becomes urgent to consider early discharge strategies in order to free up beds in the ICU. Developing an early discharge strategy should be based on an assessment of the risk of patient deterioration using simple criteria, to optimize ICU length of stay.

The aim of our study is to propose an early ICU discharge strategy after intravenous thrombolysis.

MATERIALS AND METHODS

This study was based on a retrospective analysis of prospectively collected data concerning patients treated with IV rt-PA (≤ 4 hours 30 minutes) for carotid ischemic stroke between March 2000 and August 2012 in the Cerebrovascular Emergency Department at Pitié-Salpêtrière Hospital Group. The patients were divided into two cohorts (from March 2000 to October 2009, and from November 2009 to August 2012).

The diagnosis of ischemic stroke was confirmed by MRI in 95% of cases and by CT scan in 5%. Patients who had a carotid ischemic stroke and were part of the EVALUSINV registry were included (this is a single-center database used by the GHPS stroke units, validated by the National Commission on Informatics).

Patients who had experienced a vertebrobasilar stroke and a hemorrhagic stroke were not included. The patients were informed about the collection of data concerning them for future analyses. The data were collected on the EVALUSINV form, and the statistical analysis was performed using the "R" software.

Patients were divided into 4 classes according to their NIHSS score 24 hours after thrombolysis:

- **Class A:** Score between 0 and 5
- **Class B:** Score between 6 and 10
- **Class C:** Score between 11 and 15
- **Class D:** Score 16 or higher

The hypothesis of early discharge (as soon as 24 hours after thrombolysis) was initially stated as follows: At 24 hours, patients who had nearly fully recovered (class A) and the most severe patients (class D) could be discharged from the stroke unit. Death was considered a deterioration for categories A, B, C, except for the most severe category D.

This 24-hour risk stratification and early discharge strategy was assessed in terms of feasibility in an initial cohort (cohort 1) of patients, treated between March 2000 and October 2009. The risks of the two groups (A and D, B and C) were compared in terms of neurological deterioration at day 7 (Fisher's test).

We finally checked whether the results found in the first cohort were due to chance or whether they were reproducible and therefore comparable in a second cohort (cohort 2) of patients, who were treated between November 2009 and August 2012, a kind of temporal validation on different patients seen later in time.

RESULTS

Over the study period, 617 patients were thrombolyzed for carotid acute ischemic stroke. The average age of our patients was 62 (51-75) years. The sex ratio was in favor of women. The average rt-PA delay was 190 minutes. The mean initial NIHSS was 17. There was a predominance of left-sided lesions. Most patients had an M1 occlusion.

Twenty-four hours after thrombolysis, the mean NIHSS on day 1 was 8, with a range from 2.7 to 20. Most of the patients in class A had achieved recanalization. Edematous and hemorrhagic complications were the most common and mainly occurred in patients in class D.

Mortality on day 7 of hospitalization was higher among patients in class D. At 3 months, 95% of patients were in class A, 67% in class B, 33% in class C, compared to 7% in class D.

Among patients in class A, 92% remained stable without any worsening, and 7% deteriorated, with death related to the onset of symptomatic hemorrhage.

For class B patients who had to remain in intensive care unit, 57% improved, 31% remained stable, and 8% of patients worsened. For those in class C, 55% of patients improved, 31% remained stable, and 14% of patients worsened. For the most severe patients who did not have to remain in intensive care unit, 22.7% improved, 77.2% of patients remained stable, with a mortality rate of 19%.

The rate of worsening among patients eligible for early discharge was 2.2%, compared with 12.7% among patients not eligible for early discharge (Table 1). This finding is also true for patients in cohort 1 as well as patients in cohort 2 (Table 2, Figures 1 and 2).

Tab. 1. Frequency of worsening among groups eligible for early discharge in cohort 1 patients.

Classes	No worsening	Worsening	Number and percentage
A and D	263	6	269 (2.23%)
B and C	144	21	165 (12.73%)
Note: P<0.001 Odds ratio: 6.36 (Fischer exact test)			

Tab. 2. Frequency of worsening among groups eligible or not for early discharge (cohort 2).

Classes	No worsening	Worsening	Percentage
A and D	129	2	131 (1.53%)
B and C	47	5	52 (9.62%)
Note: P: 0.02 Odds ratio: 6.77 (Fisher exact test)			

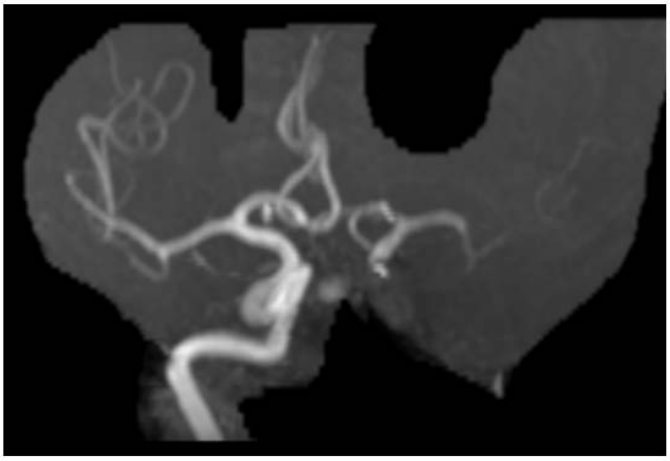

Fig. 1. MRA of the circle of Willis before thrombolysis showing IC occlusion.

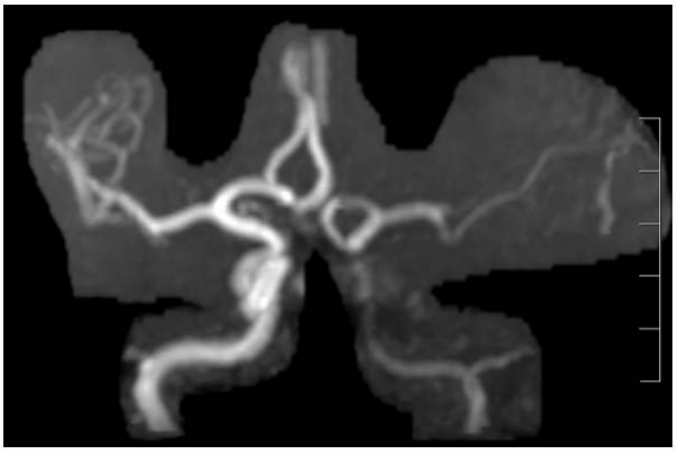

Fig. 2. MRA of the circle of Willis 24 hours after thrombolysis showing partial recanalization.

DISCUSSION

This study demonstrated that it was possible, as early as 24 hours after intravenous thrombolysis, to stratify patients admitted to a stroke unit using the NIHSS score into a high-risk class for deterioration and a lower-risk class for deterioration.

The possibility of using this stratification in an early discharge procedure from neurovascular ICU seems reasonable. From an economic standpoint, it even seems optimal, since the cost ratio between hospitalization in neurovascular ICU and a subacute unit (3/1) appears to be lower than the severity ratio of patients in the two groups (6/1).

We did not find any specific studies in the medical literature relating to an assessment or proposal for early discharge from the stroke unit after IV thrombolysis. The available studies focus on early complications based on the NIHSS score, showing a clear predominance of extra-neurological complications, particularly atrial fibrillation and aspiration pneumonia, followed by neurological complications, especially rebleeding [10-12].

These complications are related to clinical and radiological criteria. Clinically, they involve the severity of the initial NIHSS score, the association with diabetes, and the presence of a lacunar presentation. Radiologically, they include proximal occlusions, hypodensity greater than one-third of the MCA, a hyperdense MCA, and the early onset of edema [13].

In most studies, complications are mainly due to the extension of the ischemic stroke in 34%, intracranial hypertension in 27%, ischemic recurrence in 11%, and hemorrhagic transformation in 11%. The persistence of large vessel occlusion 24 hours after thrombolysis increases the risk of early post-thrombolysis complications [14].

In our study, complications were dominated by symptomatic hemorrhages at 16% and malignant edema at 11%. The absence of recanalization as a predictive factor of worsening was found in 57% of our patients.

This study nevertheless has limitations. It is a retrospective study, based on data already collected in real-life situations, with patients who were hospitalized most often for much more than 24 hours in the ICU. At the time of writing this thesis, it was not possible for us to specify whether any patients had experienced regressive neurological complications due to having received specific treatment in the ICU.

Similarly, this data comes from a single center, so it is very specific, and it would be beneficial to replicate it in another center, ideally in another country.

The early discharge strategy, although simple, may not be applicable to all patients for multiple reasons (such as factors limiting ICU discharge, for example the lack of a downstream bed, the care workload, or consideration of other prognostic information specific to the patient).

For some patients, this strategy may be considered a risk-taking approach, and therefore, if it is implemented, the actual rate of complications or serious adverse events should be closely monitored.

A health-economic analysis is an essential step to demonstrate

the cost-effectiveness of this strategy, which could not be carried out in this study.

Despite these weaknesses, this study still has many positive aspects. The early discharge strategy is based on a simple rule that can be included in a standardized care procedure. This study helps to shed light on how patients could be managed in an ICU and in a subacute care unit after a stroke treated with thrombolysis in terms of length of hospital stay.

It opens up the prospect of a randomized clinical trial, which would be the best way to prove an idea that seems very promising to us. This trial would make it possible to assess the individual effect of the early discharge decision (in terms of benefit and risk), as well as to evaluate its cost-effectiveness.

CONCLUSION

Early discharge of neurovascular ICU patients 24 hours after thrombolysis is feasible, according to a simple strategy that is acceptable to everyone and easily applicable elsewhere. This strategy is based on one of the clinical criteria, which is the NIHSS score. This score is a summary of prognostic information and allows us to distinguish, as early as day 1, two groups of different severity that may require different levels of monitoring.

All patients in groups A and D can be considered for discharge on day 1, that is, those with a NIHSS score ≤ 5 and ≥ 16. Patients in groups B and C should stay beyond day 1 as the risk of worsening is higher.

Early discharge of neurovascular ICU patients is a possibility to improve care for the patient but also for the community, that is, for patients who may be treated with thrombolysis with increased available capacity.

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