

## Positive impact of stroke unit establishment on patient recovery in Firoozgar hospital

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### Abstract

**Background:** Firoozgar Comprehensive Stroke Center started up as the first organized care unit in the country in 2014; this study was performed to investigate quality indicators such as reduction in mortality, morbidity and hospital stay.

**Methods:** Two groups of ischemic stroke patients were compared. The first group had been admitted in general neurology ward (non-stroke unit patients) and the second one received specialized stroke care in the stroke unit within a period of two years (stroke unit patients). Non-stroke unit patients were selected from a pool of patients admitted two years before establishment of stroke unit. Variables compared were factors such as modified Rankin Scale (mRS), confinement days in stroke unit or Intensive Care Unit, total days of hospitalization, history of prior stroke, receiving recombinant tissue plasminogen activator (rtPA) and the stroke category indicating anterior or posterior circulation infarct. Quantitative testing was conducted using independent t-test as well as "Mann-Whitney U Test"; Chi-squared test was used for qualitative testing.

**Results:** A total number of 129 patients enrolled in the study (66 cases of non-stroke unit patients and 63 cases of stroke unit patients). The average total days of hospitalization were 17.32 (95% CI: 0.15-36.1) in non-stroke unit patients and 21.19 (95% CI: 4.99 - 38.1) in stroke unit patients (p=0.2). Results for stroke unit patients showed a lower mRS score (OR=1.48, p=0.01).

**Conclusion:** It was concluded that stroke unit patients tend to have a better outcome and a lower mRS score at discharge. No significant difference in hospitalization period was noted between the two groups.

**Keywords:** Stroke Unit, Modified Rankin Scale (mRS), Recombinant Tissue Plasminogen Activator (rtPA).

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### Introduction

Stroke Unit is considered an integrated well-organized ward in a hospital to provide efficient care for stroke patients. To cover all aspects of recovery, a multidisciplinary approach, by a coordinated team of skilled nurses, physicians, physiotherapists, occupational therapists, social workers and

speech therapists, is essential; the team should meet at least once a week. Each member of the team shall educate patients, record quality of care, and specifically concentrate on immediate mobilization and early rehabilitation (1-4).

Many studies have shown that an organized stroke unit reduces mortality and de-

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pendency following acute stroke (5-7). American Academy of Neurology suggests admitting stroke patients in organized stroke units regardless of stroke subtype (8).

Based on Royal College of Physicians stroke guidelines, admission to an acute care unit and rehabilitation under the supervision of a specialist, are both essential for any hospital admitting patients with potential stroke (9). Although there are many different interventions that are implemented and tested in different centers, it has been revealed that what really made the difference in stroke units, were factors such as a well-organized multidisciplinary team, training of the junior team members, their cooperation in rehabilitation process and efficiently exploiting expertise; but not availability of technical staff or medications (5).

Firoozgar Comprehensive Stroke Center is similarly comprised of specialized physicians and nurses, advanced imaging modalities, current medical treatments (including thrombolysis, intravenous or intra-arterial clot dissolving agents, thrombectomy, or angioplasty) and post-stroke rehabilitation services (10).

The purpose of this study was to assess the impacts of the 2 years practice and activity within the Firoozgar Hospital Stroke Unit and the efficiency of the system to reduce morbidity, mortality, recovery time and hospital stay.

## Methods

### *Data and instrument*

All ischemic stroke patients who had registered in the hospital system in a period of 4 years were selected for the study (two years before stroke unit establishment (21 March 2008-2010) and two years after that (21 March 2010-2012)).

There were eight fully-equipped beds in the Unit with all the facilities required for acute stroke; there were 22 beds in the post-stroke ward. Patients with end-stage disease or hemorrhagic stroke were excluded from the study. A consent form was prepared and

given to patients or caretakers to be filled by them at the time of admission, and this was kept in the patient's hospital file.

To estimate stroke unit efficacy, modified Rankin Scale (mRS), number of confinement days in stroke unit or Intensive Care Unit and total days of hospitalization were recorded.

mRS is an ordinal outcome measuring scale for cerebrovascular events (11) which is being used widely in clinical trials (12,13). It contains six sequential scales represent disability as follow:

0 = No symptoms at all

1 = No significant disability despite symptoms; able to carry out all usual duties and activities

2 = Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance

3 = Moderate disability requiring some help, but able to walk without assistance

4 = Moderate severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance

5 = Severe disability; bedridden, incontinent, and requiring constant nursing care and attention

6 = death (14)

The mRS score was recorded for each patient when discharged from hospital or expired.

After stroke unit establishment, we were able to administer intravenous recombinant tissue plasminogen activator (rtPA), as a recommended treatment for acute stroke in selected patients (15,16). Receiving rtPA was also recorded as a variable.

A comparison was made between the mortality rates of the two groups; the mortality rate in patients who did not receive stroke unit care was twice that of stroke unit patients.

There were other collected data including age, sex, history of prior stroke and the stroke category indicating anterior or posterior circulation infarct according to Computed Topography (CT) scan.

### Statistical analysis

The relevant data were collected and recorded within the registry database, and then patients were divided into two groups: stroke unit patients and those in conventional ward before stroke unit establishment; the two groups were finally compared and analyzed using SPSS v.16.

Data collection was conducted through a self-administered list that included the relevant variables of the study. The sample size was calculated by census.

Comparison of quantitative variables between the two groups was tested using independent t-test and “Mann-Whitney U Test”; qualitative variables were tested by the Chi-squared test.

### Results

During the two years before stroke unit establishment in Firoozgar Hospital, sixty six patients with ischemic stroke had been treated in a conventional neurology ward, or if required, in a general Intensive Care Unit (group A). They included 36 men and 30 women and the mean age was  $71.18 \pm 8.19$  years (95% CI: 58.08–84.28). After stroke unit establishment, there were 63 ischemic stroke patients in a period of two years, including 30 men and 33 women, who were labeled as group B in this study. The mean age was  $71.63 \pm 8.35$  years (95% CI: 58.66–84.6); frequency distribution is presented in Table 1. There was no significant difference between the two groups according to sex ( $p=0.48$ ) or age ( $p=0.84$ ).

Of all the 129 patients, 34 (26%) had a history of previous Cerebro-vascular Accident that was a contributory factor to a higher final mRS score (OR=2.2  $p=0.01$ ). About 35 (27%) cases suffered posterior circulation infarct, whereas 94 (73%) cases suffered anterior circulation infarct. With

regards to frequency of death (mRS score of 6) that was 40% ( $n=14$ ) in patients with posterior circulation infarct versus 33% ( $n=31$ ) in those with anterior circulation infarct, this study shows that anterior circulation infarct increases the mRS score by 2.68 times (OR=2.68,  $p=0.01$ ).

Among stroke unit patients, 18 (28.6%) cases had an indication for rtPA treatment; these patients were more likely to have a better outcome and a lower mRS score at discharge (OR=1.36,  $p=0.02$ ).

The number of days spent in ICU and days spent in stroke unit, were 14.8 and 11.6, respectively; however, these figures were not statistically significant ( $p=0.6$ ). The average total days of hospitalization was 17.32 (95% CI: 0.15–36.1) in non-stroke unit patients and 21.19 (95% CI: 4.99 - 38.1) in stroke unit patients, with no significant difference ( $p=0.2$ ).

The two groups were compared according to the respective final mRS scores; the results showed that, in comparison with patients receiving general Intensive Care Unit care in pre-stroke unit period, patients receiving stroke unit care tend to have a better outcome and a lower mRS score at discharge (OR=1.4,  $P=0.01$ ). Mortality rate in patients who did not receive stroke unit care was twice that of those who did (OR=2,  $P=0.01$ ).

### Discussion

The results of the current study show that well-coordinated stroke care improves rehabilitation and recovery outcomes, but does not lead to early discharge. Formerly, rehabilitation process took place by the community services after discharge, but in case of stroke unit, acute care and rehabilitation both progress concurrently; this may also imply that early discharge is not necessarily a true reflection of early recovery.

Table 1. Number of patients in each group by age

Unit establishment	Age (yrs)				Total
	20–40	41–60	61–80	81–100	
Before stroke unit establishment (Group A)	1 (1.6%)	11 (16.6%)	35 (53%)	19 (28.8%)	66 (100%)
After stroke unit establishment (Group B)	1 (1.6%)	9 (14.3%)	33 (52.4%)	20 (31.7%)	63 (100)

In a previous trial that combined stroke unit care with early supported discharge as "extended stroke unit service", it has been demonstrated that this service will improve long-term outcome in addition to reducing hospital stay (17). Another one came with the cost-effectiveness of combined stroke unit care with early supported discharge and concluded it was favorable (18).

As we found anterior circulation infarct causes higher mRS scores, different frequency of patients with anterior circulation infarct in each study group, could have an impact on final mRS scores and could therefore be considered as selection bias reflecting a better outcome in stroke unit. Due to larger number of anterior circulation infarct cases in stroke unit patients, future trials, excluding anterior circulation infarct as a matched variable, will achieve stronger evidence.

Another major issue about this research refers to the time bias. Since the two study groups were enrolled in different time periods, it cannot be concluded for sure that any observable improvement in outcome would only stem from the stroke unit intervention; other time-dependent factors such as the difference in care protocols, improvement in staff knowledge and skills in the two years, and wider availability of medications (such as rtPA), could all have an impact on the outcomes.

### Limitation

In this study, we should mention that our data for infarct size was limited; in addition, the amount of data was not sufficient to draw an mRS table; this shall be one of our main objectives in future studies.

### Conclusion

We concluded that patients receiving specialized care in stroke unit had an overall better outcome and a lower mortality at discharge. There was no significant difference in reduction of hospital stay.

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