Stroke Thrombolysis Protocol Shortens "Door-to-Needle Time" and Improves Outcomes—Experience at a Tertiary Care Center in Qatar

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Background and Purpose: To assess the effect of acute thrombolysis protocol on "door-to-needle time" (DTN) and improvement in outcome following acute stroke (AS). *Methods:* The charts of all patients receiving intravenous (IV) thrombolysis for AS between January 2008 and June 2015 were reviewed for DTN, complications, and clinical outcome. Good prognosis was defined as modified Rankin Scale (mRS) score of less than 2 at 90 days. In January 2014, a protocol for faster DTN was introduced. We reviewed the prognosis before and after the introduction of the new protocol. *Results:* Up to 204 patients received IV recombinant tissue plasminogen activator (r-tPA) (mean age 52.5 ± 12.4 years). Mean door-to-CT time improved from 42.5 ± 41.1 to 27.1 ± 26.3 minutes ($P < .001$); DTN improved from 83.26 ± 47.7 to 47.09 ± 25.7 minutes ($P < .001$). Complications were reduced from 15.7% to 8.8% ($P = .14$). The mRS score of less than or equal to 2 improved from 47.1% to 73.3% at 90 days ($P = .001$). After implementing new protocol, thrombolysis rate increased to 11.8% in 2014 (before 3.3% in 2011, 4.9% in 2012, and 4.4% in 2013), $P < .0001$. NIHSS (National Institutes of Health Stroke Scale) score at admission ($P = .002$), hypodensity on initial CT brain ($P = .041$), protocol implementation ($P = .014$), and reduced length of stay ($P = .004$) were associated with outcome at 90 days (mRS score ≤2). *Conclusion:* Implementation of specific protocols to reduce DTN in patients receiving IV r-tPA leads to reduction in complications and improves outcome. **Key Words:** Thrombolysis—cerebral infarction—thrombolysis—acute stroke—Qatar—cerebral hemorrhage.

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Introduction

Thrombolysis and endovascular clot retrieval are the only acceptable treatments of acute ischemic stroke (AIS).[1,2] There is evidence that early treatment leads to better outcome.[2] Two stroke programs recently published their experience on "ultrafast" protocols for the treatment of AIS with "door-to-needle time" (DTN) averaging 30 minutes.[3,4] The objective of our study was to investigate if implementing a new stroke protocol results in improvement of DTNs and prognosis.

Subjects and Methods

We studied the details of patients who received intravenous recombinant tissue plasminogen activator (r-tPA) for acute stroke at Hamad General Hospital in Doha, Qatar, between January 2008 and June 2015. We recorded the demographics, risk factors, stroke etiology, NIHSS (National Institutes of Health Stroke Scale) score on arrival, door-to-CT time (DCT), DTN, complications, length of stay (LOS), and prognosis using modified Rankin Scale (mRS) score at 3 months. Good prognosis was defined as achieving mRS score of less than or equal to 2. Stroke patients were seen in the Emergency Department (ED) by the neurology team, and decisions about thrombolysis and management are made on an urgent basis. Patients were admitted to medical ward for follow-up before January 2014; after implementing the new protocol, patients were admitted to the stroke unit and followed up by stroke neurologist, physician, rehabilitation physician, specialized nurse, occupational therapist, speech therapist, and physiotherapist. All discharged patients were routinely followed up in the stroke clinic after 3 months to assess outcome and mRS score, including patients who were still in the rehabilitation unit. If patients were not routinely followed up in the clinic, 90-day mRS score was recorded through telephone interview by either stroke physician or trained personnel.

We compared the outcomes between 2 groups. Group 1 consisted of patients admitted prior to implementation of stroke protocol in January 2014. Group 2 comprised patients admitted after January 2014. The new protocol included prior notification by Emergency Medical Services (EMS) to ED team, a code stroke protocol (rapid notification of the stroke team via a linked paging system), initiation of r-tPA in the CT scanner room, and setting up of a multidisciplinary group comprising ED physicians, nurses, and the stroke team.

Descriptive results are reported as mean ± standard deviation or median with interquartile range (IQR) and frequency (percentages) for continuous and categorical variables, respectively. Independent sample *t*-test, Mann–Whitney *U*-test, Pearson chi-square test, or Fisher exact test whenever appropriate was used to assess the relationship of demographic and clinical factors between the 2 groups. Multiple logistic regression models were used to identify the statistically significant factors associated with good outcome at 90 days after adjusting for potentially confounding factors. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 22 (Released 2012, IBM SPSS Statistics for Windows, Version 21.0.; IBM Corp., Armonk, NY). A "*P*" value <.05 (two tailed) was considered significant.

Results

Demographic and clinical factors comparing patients admitted are summarized in Table 1. After implementing the new protocol, the thrombolysis rate increased to 11.8% in 2014 from 3.3% in 2011, 4.9% in 2012, and 4.4% in 2013, $P < .0001$. The mean time from symptom onset to arrival at ED was 105.2 ± 55.5 minutes after protocol (before 79.9 ± 42.1), $P < .001$. NIHSS score was similar in both groups (11.8 ± 4.6 versus 10.9 ± 5.2, $P = .22$). Large

Table 1. *Comparison of patients who received IV r-tPA before and after implementation of stroke protocols (n = 204)*

	Before 2014 (n = 102)	After 2014 (n = 102)	*P* value
Age	52.2 ± 12.4	52.8 ± 12.6	.73
Sex (male)	82 (80.4)	84 (82.4)	.72
Coronary artery disease	19 (18.6)	8 (7.8)	.023
Arrival time at ED (min)	79.9 ± 42.1	105.2 ± 55.5	<.001
NIHSS score	11.8 ± 4.6	10.9 ± 5.2	.22
Door-to-CT time (min)	42.5 ± 42.1	27.1 ± 26.4	<.001
Door-to-needle time (min)	83.26 ± 47.7	47.09 ± 25.7	<.001
Early hypodensity on CT brain	17 (16.7)	47 (46.1)	<.001
Door-to-needle time less than or equal to 60 minutes	43 (42.2)	76 (74.5)	<.001
Door-to-needle time less than or equal to 30 minutes	2 (2.0%)	33 (32.4%)	<.001
Complications (all events)	16 (15.7%)	9 (8.8%)	.14
Mortality	8 (7.8%)	4 (3.9%)	.23
Hemorrhagic complications	17 (16.7%)	10 (9.8%)	.15
Symptomatic bleed	6 (5.9%)	6 (5.9%)	.99
Length of stay in days	7 (4-13.3)	4 (2-6)	<.001
mRS less than or equal to 2 at 90 days	48 (47.1%)	74 (73.3%)	.001

Abbreviations: CT, computed tomography; ED, emergency department; IV, intravenous; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; r-tPA, recombinant tissue plasminogen activator.

Results are expressed as mean ± standard deviation, median (interquartile range), and frequency (%). Nine patients (4.4%) are missing in prognosis at 3 months because of unavailable data.