DOI: http://dx.doi.org/10.18502/cjn.v21i2.10497

Current Journal of Neurology

Short Communication

Curr J Neurol 2022; 21(2): 133-5

# The effect of prehospital notification by emergency medical service on outcomes in patients receiving recombinant tissue-type plasminogen activator (r-tPA)

Received: 26 Nov. 2021
Accepted: 08 Feb. 2022

Shahram Rafie[1], Narges Mofrad-Booshehri[2], Davood Shalil-Ahmadi[1], Elham Maraghi[3]

[1] Department of Neurology, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[2] Student Research Committee, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[3] Department of Biostatistics and Epidemiology, School of Public Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

**Keywords**
Thrombosis; Emergency Medical Services; Treatment Outcome; Tissue Plasminogen Activator

**Abstract**

**Background:** According to the American Heart Association and American Stroke Association (AHA/ASA) guidelines, in acute stroke, the door-to-computed tomography (CT) scan (DTC) time should be less than 25 minutes, and time to injection of recombinant tissue-type plasminogen activator (r-tPA) [door-to-needle (DTN) time] should be less than 60 minutes.

**Methods:** We had a tendency to prospectively collect the clinical and time information of patients who received r-tPA during one year after the initiation of prehospital notification (PN). Patients were divided into three groups, covering patients transferred by Emergency Medical Service (EMS) with and without PN, and non-EMS. We then contrasted the impact of EMS with PN and EMS use on onset-to-needle time (ONT), and the neurological outcome. Good outcome was determined as Modified Rankin Scale (MRS) ≤ 2 at 3-month follow-up.

**Results:** Among 102 studied patients, 64% were transferred by EMS, of whom 53.9% entered PN. Compared with non-PN groups, EMS with PN group showed significantly shorter DTN and DTC time, as well as ONT.

**Conclusion:** Our study showed that EMS with PN, rather than EMS, significantly improved stroke outcome by shortening of ONT.

**How to cite this article:** Rafie S, Mofrad-Booshehri N, Shalil-Ahmadi D, Maraghi E. The effect of prehospital notification by emergency medical service on outcomes in patients receiving recombinant tissue-type plasminogen activator (r-tPA). Curr J Neurol 2022; 21(2): 133-5.



Corresponding Author: Davood Shalil-Ahmadi
Email: shalilahmadi@gmail.com

## Introduction

Studies have displayed that the sooner, the thrombolytic therapy given to stroke patients, make better outcome and lower complication rate.[1-3] Therefore, more efforts are needed to shorten the time between the onset of stroke symptoms and the initiation of thrombolytic therapy. Most of Iranian general populations have little awareness about stroke.[4] The American Heart Association and American Stroke Association (AHA/ASA) guidelines recommend that Emergency Medical Service (EMS) systems should be utilized once stroke is suspected.[5] Prehospital notification (PN) by EMS personnel can prepare the resources of the destination hospital before patient arrival, and it has been displayed to speed up the hospital management measures for patients with stroke.[6]

## Materials and Methods

For this study, we enrolled patients who received intravenous thrombolytic (IVT) between November 2019-2020 in Ahvaz City, Iran. We prospectively designed a systemized prehospital notification study by cooperating with local EMS. All EMS paramedics in Ahvaz City are trained for early detection and transportation of patients with stroke; so, they call the stroke team if a suspected patient meet any of Face-Arm-Speech-Time (FAST) items when they are still on the ambulance.[7] Upon arrival, the patient would be immediately transferred to image room after blood drawing by nurses.

Pretreatment demographic, time, clinical, and imaging data, and co-morbid conditions including history of hypertension, diabetes, atrial fibrillation, etc., were prospectively collected in the stroke database. IVT was administered according to the international guidelines.

We assessed the time from the arrival to imaging time [door-to-computed tomography (CT) scan (DTC) time], and arrival to bolus intravenous recombinant tissue-type plasminogen activator (r-tPA) [door-to-needle (DTN) time], and onset to bolus intravenous r-tPA [onset-to-needle time (ONT)]. Stroke severity was assessed at baseline with the National Institutes of Health Stroke Scale (NIHSS).[8]

Neurological outcome at 3 months was evaluated using Modified Rankin Scale (MRS). Good outcome was determined as 3-month MRS score of 0-2.[9]

All data analyses were performed using the SPSS statistical software (version 20, IBM Inc., Armonk, NY, USA).

## Results

102 patients were included in analysis with a mean age of 67 years, and 45.1% of them were women. The mean baseline NIHSS was 13, with a mean ONT of 139.34, and DTN time of 35.36 minutes. Totally, 64.0% patients transferred by EMS, of whom, 53.9% patients had PN.

As shown in the table 1, compared with non-EMS group, patients transferred by EMS, had a shorter DTN and DCT times.

The comparisons between PN and non-PN group showed significant differences in ONT, and DTN and DCT times, and MRS ≤ 2 after 3 months.

Unadjusted comparison showed differences in the rate of good outcome (P = 0.003) among three groups that patients in EMS with PN group had a higher rate of good outcome in comparison to EMS without PN and non-PN groups (90.9% vs. 45.5% and 88.9%, respectively; P < 0.001).

Unadjusted comparison between patients with or without good outcome showed that patients with good outcome had lower baseline NIHSS score, fewer had hyperlipidemia, more came with EMS-PN group, and ONT. After adjustment of these items, multivariate regression analysis showed that EMS was not associated with outcome (P = 0.479), but EMS without PNP group was associated with outcome (P = 0.041) but not better than other groups. However, EMS with PN (P = 0.680) had better outcome than others, but its association was not significant. After adjusting ONT into the regression analysis, only baseline NIHSS had good outcome independently (P = 0.002).

## Discussion

Our study displays that PN by EMS reduces the DTN time, because of shorter delays in arriving at the hospital, and leads to reduce in hospital delays; so, we found that PN, rather than EMS, was associated with the improvement of neurological outcome. Our results are similar to the study in Chinese urban area.[10]

However, the contradiction in our result with that study is the lack of superiority of ONT and DCT time of the EMS without PN than non-EMS group; this negative finding might be due to complicated cases and worsen baseline MRS of this group.

Limitations in this study include a small sample size and potential selection bias.

**Table 1.** Unadjusted comparisons among patients transferred by EMS with or without PNP and non-EMS patients

| | Non-EMS (n = 36) | EMS without PNP (n = 11) | EMS with PN (n = 55) | Test value | P |
|---|---|---|---|---|---|
| Age (year) | 65.47 ± 14.01 | 75.45 ± 10.85 | 68.07 ± 12.91 | 3.686 | 0.158 |
| Women | 15 (41.7) | 6 (54.5) | 25 (45.5) | 0.571 | 0.752 |
| Smoking status | 5 (13.9) | 2 (18.2) | 8 (14.5) | 0.126 | 0.939 |
| Hypertension | 20 (55.6) | 8 (72.7) | 30 (54.5) | 1.274 | 0.529 |
| Diabetes mellitus | 12 (33.3) | 6 (54.5) | 9 (16.4) | 8.212 | 0.016 |
| Atrial fibrillation | 5 (13.9) | 3 (27.3) | 7 (12.7) | 1.576 | 0.455 |
| Previous TIA/stroke | 7 (19.4) | 1 (9.1) | 8 (14.5) | 0.800 | 0.670 |
| Hyperlipidemia[*,£] | 4 (11.1) | 5 (45.5) | 7 (12.7) | 8.304 | 0.016 |
| Rehabilitation | 11 (30.6) | 2 (18.2) | 15 (27.3) | 0.650 | 0.723 |
| Baseline NIHSS score (IQR)[£] | 14 (7.25-18.00) | 16 (10-23) | 12 (8-18) | 1.782 | 0.410 |
| Baseline MRS 0-2 | 36 (100) | 9 (81.1) | 54 (98.2) | | 0.006 |
| Time tracking information | | | | | |
| Onset-to-needle time (minute)[*] | 145.36 ± 51.70 | 170.90 ± 43.00 | 129.09 ± 53.02 | 3.385 | 0.038 |
| Door-to-CT time (minute)[*,¥] | 16.52 ± 7.05 | 17.09 ± 6.33 | 8.60 ± 3.44 | 44.06 | < 0.001 |
| Door-to-needle time (minute)[¥] | 42.77 ± 26.27 | 39.81 ± 15.79 | 29.61 ± 13.87 | 9.110 | 0.011 |
| Door-to-CT time ≤ 25 minutes | 32 (88.9) | 10 (90.9) | 55 (100) | - | 0.044 |
| Door-to-needle time ≤ 60 minutes | 31 (86.1) | 10 (90.9) | 53 (96.4) | - | 0.203 |
| Neurological outcomes | | | | | |
| Good Outcome [*,£] | 32 (88.9) | 5 (45.5) | 50 (90.9) | 15.672 | < 0.001 |
| Dead | 1 (2.8) | 4 (36.0) | 3 (5.4) | 14.091 | 0.001 |

The results are mentioned as mean ± standard deviation (SD) and number (percent).
EMS: Emergency medical service; PN: Prehospital notification; TIA: Transient ischemic attack; NIHSS: National Institute of Health Stroke Scale; IQR: Interquartile range; MRS: Modified Rankin score
[*]EMS without PNP vs. EMS with PNP, P < 0.050; [£]Non-EMS vs. EMS without PNP, P < 0.050; [¥]Non-EMS vs. EMS with PNP, P < 0.050

The strengths of this study are as the results are showing shorter DTN and DCT times in case of prehospital notification; and the DCT time ≤ 25 minutes registered in 95% cases, and the DNT time ≤ 60 minutes in 92% cases in accordance with the purpose of AHA/ASA guideline.[5]

## Conclusion

T Prehospital notification by shortening of ONT significantly improved stroke outcome.

## Conflict of Interests

The authors declare no conflict of interest in this study.

## Acknowledgments

None.

## References

1. Sadeghi-Hokmabadi E, Yazdchi M, Farhoudi M, Sadeghi H, Taheraghdam A, Rikhtegar R, et al. Prognostic factors in patients with acute ischemic stroke treated with intravenous tissue plasminogen activator: The first study among Iranian patients. Iran J Neurol 2018; 17(1): 31-7.
2. Lees KR, Bluhmki E, von Kummer R, Brott TG, Toni D, Grotta JC, et al. Time to treatment with intravenous alteplase and outcome in stroke: An updated pooled analysis of ECASS, ATLANTIS, NINDS, and EPITHET trials. Lancet 2010; 375(9727): 1695-703.
3. Fonarow GC, Smith EE, Saver JL, Reeves MJ, Bhatt DL, Grau-Sepulveda MV, et al. Timeliness of tissue-type plasminogen activator therapy in acute ischemic stroke: patient characteristics, hospital factors, and outcomes associated with door-to-needle times within 60 minutes. Circulation 2011; 123(7): 750-8.
4. Borhani HA, Karimi AA, Amiri A, Ghaffarpasand F. Knowledge and attitude towards stroke risk factors, warning symptoms and treatment in an Iranian population. Med Princ Pract 2010; 19(6): 468-72.
5. Jauch EC, Saver JL, Adams HP, Bruno A, Connors JJ, Demaerschalk BM, et al. Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2013; 44(3): 870-947.
6. Sheppard JP, Mellor RM, Greenfield S, Mant J, Quinn T, Sandler D, et al. The association between prehospital care and in-hospital treatment decisions in acute stroke: a cohort study. Emerg Med J 2015; 32(2): 93-9.
7. Brandler ES, Sharma M, Sinert RH, Levine SR. Prehospital stroke scales in urban environments: A systematic review. Neurology 2014; 82(24): 2241-9.
8. National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. N Engl J Med 1995; 333(24): 1581-7.
9. van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. Interobserver agreement for the assessment of handicap in stroke patients. Stroke 1988; 19(5): 604-7.
10. Zhang S, Zhang J, Zhang M, Zhong G, Chen Z, Lin L, et al. Prehospital notification procedure improves stroke outcome by shortening onset to needle time in Chinese urban area. Aging Dis 2018; 9(3): 426-34.