

EM ADVANCES

A door-to-needle time of 30 minutes or less for myocardial infarction thrombolysis is possible in rural emergency departments

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ABSTRACT

Objective: The Canadian Emergency Cardiac Care Coalition, the American Heart Association and similar groups have established a benchmark for the administration of thrombolytics in acute myocardial infarction (AMI) care as a door-to-needle (DTN) time of 30 minutes or less. Previous research suggests that this goal is not being achieved in Canada. The purpose of this study was to determine whether the target DTN time of 30 minutes or less for thrombolysis could be met in 2 rural Ontario emergency departments (EDs).

Methods: We conducted a retrospective chart review and obtained descriptive data for each case, including demographic information and the Canadian Emergency Department Triage and Acuity Scale (CTAS) score. Visit timeline data were also collected and included the time during which patients saw a physician, had an electrocardiogram (ECG), received thrombolytic therapy and were discharged from the ED. Relevant time intervals, such as the median DTN time, were calculated.

Results: A total of 454 charts were reviewed for patients with a diagnosis of AMI who were seen between 1996 and 2007. The final sample consisted of 101 patients who received thrombolytics (63% men) whose median age was 67 years and median CTAS score was Level II (Emergent). The median door-to-ECG time was 6 minutes, door-to-physician time was 8 minutes and DTN time was 27 minutes; 58% of patients received thrombolytics within 30 minutes.

Conclusion: A DTN time of 30 minutes or less is achievable in rural EDs.

Keywords: myocardial infarction, door-to-needle time, thrombolysis, fibrinolysis, rural

RÉSUMÉ

Objectif : La Coalition des soins d'urgence cardiaque, l'American Heart Association et d'autres groupes connexes ont établi un point de référence concernant l'administration de thrombolytiques en cas d'infarctus aigu du myocarde (IAM) : le délai « entre l'arrivée et l'injection » devrait être de 30 minutes ou moins. Des recherches antérieures suggèrent que cet objectif n'est pas atteint au Canada. Le but de cette étude était de déterminer s'il était possible d'amorcer une thrombolyse dans le délai établi de 30 minutes ou moins, dans deux salles d'urgence d'hôpitaux ruraux en Ontario.

Méthodes : Nous avons effectué une étude rétrospective de dossiers et obtenu des données descriptives pour chaque cas, y compris des données démographiques et le niveau de triage selon

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l'échelle canadienne de triage et de gravité (ÉTG). Nous avons aussi recueilli des données relatives aux délais lors des visites à l'urgence, telles que le temps écoulé avant que le patient voie le médecin une première fois, qu'il subisse un électrocardiogramme (ECG), qu'il fasse l'objet d'une thérapie thrombolytique et qu'il obtienne son congé de l'urgence. Nous avons aussi calculé des intervalles de temps pertinents, tels que le délai médian « entre l'arrivée et l'injection ».

Résultats : Au total, nous avons examiné 454 dossiers de patients ayant un diagnostic d'IAM qui ont vu un médecin à l'urgence entre 1996 et 2007. L'échantillon définitif se composait de 101 patients qui ont reçu des thrombolytiques (63 % d'hommes) dont l'âge médian était de 67 ans et le niveau de triage médian selon l'ÉTG était le niveau II (très urgent). Le délai médian « entre l'arrivée et l'ECG » était de 6 minutes, le délai « entre l'arrivée et l'évaluation médicale du médecin » était de 8 minutes et le délai « entre l'arrivée et l'injection » était de 27 minutes. Cinquante-huit pour cent des patients ont reçu des thrombolytiques en 30 minutes ou moins.

Conclusion : Un délai « entre l'arrivée et l'injection » de 30 minutes ou moins est réalisable dans les urgences en région rurale.

Introduction

The Canadian Emergency Cardiac Care Coalition (ECCC), the American Heart Association (AHA) and similar groups have published guidelines urging timely reperfusion of patients with acute myocardial infarction (AMI).^{1,2} These guidelines have established a door-to-needle (DTN) time of 30 minutes or less for the administration of thrombolytic therapy. Meeting this benchmark is vital for patient outcomes as it has been shown that mortality rates increase with delays in DTN time.³⁻⁵ Because of this, DTN time is often used as a cardiac care quality indicator.^{6,7}

Previous research suggests that the ECCC and AHA benchmark for DTN time is unmet in a significant proportion of cases. For example, a study of 11 574 ST-segment elevation myocardial infarction cases across Canada from the FASTRAK II database determined that the mean DTN time between 1998 and 2000 was 69 minutes.⁸ In that study, only 27% of patients received thrombolytic treatment in less than 30 minutes.

On a provincial level, the Canadian Cardiovascular Outcomes Research Team (CCORT) conducted a detailed study of the quality of cardiac care in Ontario from 1999 to 2001: the Enhanced Feedback for Effective Cardiac Treatment (EFFECT) study.^{6,9} This consisted of retrospective chart reviews of 5958 AMI cases. The 2 groups of rural Ontario hospitals that were included in the study had mean DTN times of 40 minutes ($n = 7$) and 46 minutes ($n = 4$), respectively.^{7,9}

Another Canadian study looked at 12 rural Alberta hospitals from 2001 to 2002. It identified 177 cases of AMI treated with thrombolytic therapy. The mean DTN time in this study was 103 minutes, and only 7.1% of patients received treatment within 30 minutes.¹⁰

The achievement of the guidelines from the ECCC and AHA for the administration of thrombolytic therapy for AMI within 30 minutes by a rural hospital has not been described in the literature. Our experience at 2 rural emergency departments (EDs) in southwestern Ontario suggested this benchmark was being achieved at these hospitals. The purpose of this study was to determine if the median DTN time for AMI over a 10-year period at these hospitals met the ECCC and AHA guidelines.

Methods

Two rural hospitals in southwestern Ontario (South Huron Hospital [SHH] in Exeter, and Alexandra Marine and General Hospital [AMGH] in Goderich) were data collection sites in this study. Both facilities provide 24-hour ED care using an on-call emergency physician (EP) for populations of less than 10 000. The EP is not required to remain on site but must be within 15 minutes' travel of the hospital when on shift. The average ED patient volume for SHH and AMGH are 11 000 and 14 000 visits, respectively. Ethics approval for the study was granted from each hospital.

Data collection and analysis

A medical student collected the data through a retrospective chart review. Several of the chart review guidelines detailed by Gilbert and colleagues¹¹ were incorporated. Specifically, the medical student was trained in abstraction and the use of standardized abstraction forms. Furthermore, a second investigator periodically monitored abstraction performance through meetings, random revision of 15% of the included charts and verification that the correct data were used for statistical calculations.

Patient charts with visits between October 1996 and

November 2007 that were coded as AMI (International Classification of Diseases, 9th Revision [ICD-9] code 410.xx or International Statistical Classification of Diseases and Related Health Problems [ICD-10] code I21.xx) were obtained for potential inclusion. Cases were excluded if the patient was

- given thrombolytic therapy after being admitted to hospital,
- given thrombolytic therapy outside of the ED,
- not given thrombolytic therapy with tenecteplase or tissue plasminogen activator during their visit,
- suffered an AMI after triage, or
- had visit timeline data that was incompletely documented with respect to the administration of thrombolytics.

Data collected included patients' age, sex, and Canadian Emergency Department Triage and Acuity Scale (CTAS) score on triage and ED visit timeline data including the time that the patient first saw the attending EP, had an electrocardiogram (ECG), received thrombolytic therapy and was discharged.

The visit timeline data were used to calculate the following intervals: nurse triage to the first ECG assessment (door-to-ECG), nurse triage to EP assessment (door-to-physician [DTP]), DTN and length of ED stay. Summary descriptive statistics were calculated for each of these data elements using MedCalc for Windows, version 9.2.0.0 (MedCalc Software).

Results

A total of 454 charts for patients with a diagnosis of AMI

seen between 1996 and 2007 were obtained from the medical records departments of both hospitals and reviewed. Of these patients, 118 received thrombolytic therapy (51 from SHH and 67 from AMGH). A further 17 cases were excluded (6 from SHH and 11 from AMGH) because 6 of the patients were given thrombolytic therapy as inpatients, 2 experienced onset of AMI after ED triage and 9 of the records contained incomplete visit timeline data with respect to thrombolytic administration. This left a total sample of 101 charts for analysis (Fig. 1).

The median age of the included patients was 67 years and 63% were men. Descriptive statistics of patients' age, CTAS score and visit timeline for both hospitals are provided in Table 1.

The combined median DTN time for both hospitals was 27 minutes (25 min for SHH and 30 min for AMGH). The median length of stay in the ED was 2 hours, 20 minutes (2 h 35 min for SHH and 2 h 13 min for AMGH).

Table 1. Patients' age, CTAS score and visit timeline

Variable	No. of patients	Time, h:min*		
		Minimum	Maximum	Median
Age, yr	101	38	88	67
CTAS score	100	1	3	2
DTE	101	0:00	1:32	0:06
DTP	98	0:00	1:30	0:08
DTN	101	0:05	2:47	0:27
ED LOS	100	0:39	4:40	2:20

*Unless otherwise indicated.
 CTAS = Canadian Emergency Department Triage and Acuity Scale;
 DTE = door-to-electrocardiogram; DTN = door-to-needle; DTP = door-to-physician;
 ED = emergency department; LOS = length of stay.

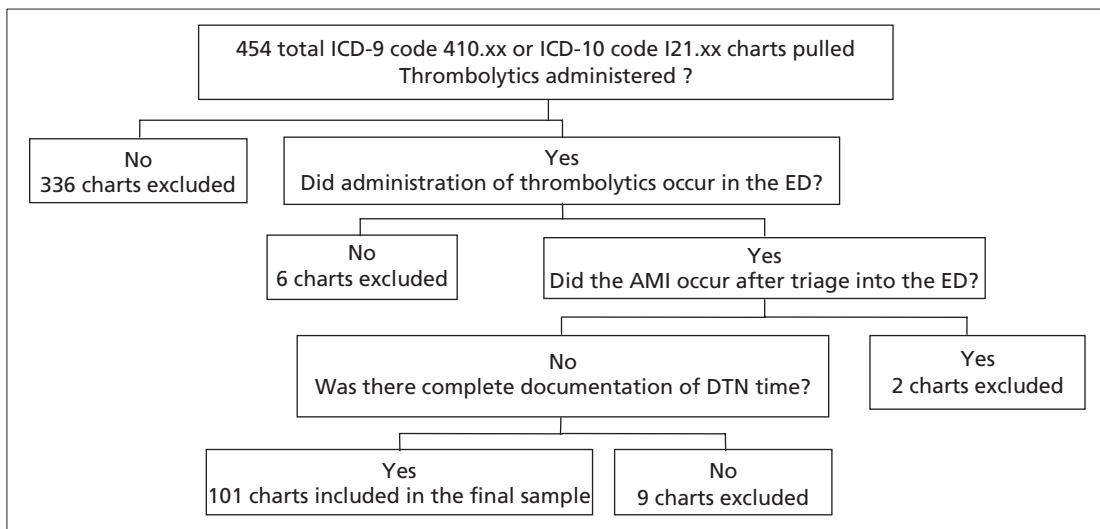


Fig. 1. Derivation of final sample. AMI = acute myocardial infarction; DTN = door-to-needle; ED = emergency department; ICD = International Classification of Diseases.

Fifty-eight percent of patients given thrombolytic therapy met the ECCC and AHA guideline DTN goal of 30 minutes or less (64% for SHH and 52% for AMGH) (Fig. 2).

Discussion

The purpose of our study was to determine if the ECCC and AHA guidelines for a DTN time of 30 minutes or less could be met in 2 rural Ontario EDs. The combined median DTN time was 27 minutes and the benchmark was met at both sites. Several factors may have contributed to this positive outcome.

CTAS guidelines provide a standard for the timely care of ED patients. The median CTAS score for patients in this study was Level II (Emergent), which indicates that EP assessment should occur within 15 minutes.¹² Previous research completed at SHH indicated that patients in the ED who were coded as CTAS Level II were seen, on average, in 12 minutes.¹³ This indicates timely patient care and may have contributed to these hospitals achieving a DTN time of within 30 minutes in our study.

Perhaps the most influential factor in determining the DTN time is the DTP time. The decision to administer thrombolytics cannot be made until the EP has interpreted the ECG and evaluated the patient for indications and contraindications to treatment. Logistically, this must be accomplished quickly if the 30 minutes or less goal is to be met, and emphasizes the necessity of the early diagnosis of AMI.

In our study, the median DTP time was 8 minutes, leaving the EP ample time to make the diagnosis and determine a management strategy. There was a 3-minute difference between SHH (7 min) and AMGH (10 min), which could explain the slightly longer DTN time observed at AMGH. It should be noted that the provincial median for time to physician assessment of CTAS Level II patients is 36 minutes.¹⁴ This is likely a factor in why the provincial

DTN seen in the EFFECT trial exceeded the ECCC and AHA thrombolysis benchmark and why only one-third of patients received treatment within 30 minutes.^{7,9,15}

Research has suggested that a major contributing factor to improved DTN times is who decides to administer thrombolytics. DTN times were 11 minutes shorter in the CCORT study when the EP, rather than the attending physician in the critical care unit (CCU) or intensive care unit (ICU), made the decision to administer thrombolytic therapy.^{7,9} In a study by Tu and colleagues,^{7,9} 36% of the included cases were given thrombolytics on the order of the attending physician in the ICU or CCU rather than an EP. In a study from the United Kingdom,¹⁶ a decrease in median DTN time from 50 to 15 minutes was measured when ED nurses were given the authority to administer thrombolytics, compared with the prior system requiring the orders of junior doctors or their superiors. This evidence may warrant an audit of thrombolytic administration protocol in Canada to determine alternate methods of safely and consistently meeting the 30-minute goal. In both of the rural hospitals used in this study, the EP decides whether to administer thrombolytic therapy and this likely contributes to faster care than has been demonstrated provincially where systems vary.

Another factor shown to delay treatment is whether thrombolysis is given in the ED versus the ICU or CCU, which can add up to 10 minutes to the DTN time.^{8,17} Again, at both rural sites, the thrombolytic treatment was administered in the ED, leading to a shorter DTN time.

Overcrowding has also been shown to contribute to delays in the delivery of optimal ED cardiac care. A study examining the impact of crowding on DTN times in Ontario during 2004 determined that ED patient crowding has a significant negative impact, increasing the chance of a delay in administration of thrombolytics by 40%.¹⁷ Neither SHH or AMGH experience serious ED crowding conditions. This may have factored into why 58% of patients received thrombolysis within 30 minutes, which was more than double what had been previously reported.^{7,9}

Limitations

This paper is limited by sources of error common to all chart reviews and retrospective analyses. For example, the documentation of clinical occurrences is subject to several sources of error.¹¹ Those directly pertinent to this paper include errors in the basic data, incomplete timeline data for patients who received thrombolytics, transfer of information from chart to database and the difficulty in reaching strong cause-and-effect conclusions.

Another possible limitation is the modest sample size ($n = 101$) from a single rural region of Ontario. Future

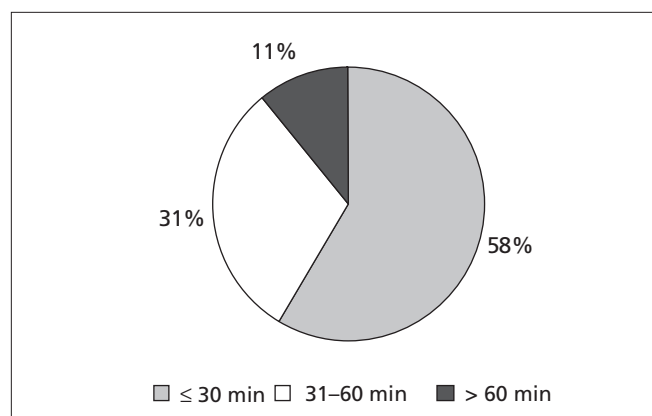


Fig. 2. Door-to-needle time categorization of study patients.

researchers may choose to compare DTN times from rural hospitals across Ontario and Canada.

Conclusion

This study demonstrates that a DTN time of 30 minutes or less is achievable in rural emergency departments.

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