Prehospital recognition of acute myocardial infarction

Howie Bright, MD;[*†] Jeff Pocock, MB[*]

ABSTRACT

Introduction: Paramedics often provide advance notice of patients with suspected acute myocardial infarction (AMI) so that emergency department (ED) staff can prepare for early aggressive management and expeditious thrombolysis, but the validity of this practice is unclear. Our objective was to determine the accuracy of prehospital AMI diagnosis by Paramedic Level III (ALS) attendants.

Methods: ALS paramedics serving a busy community hospital were instructed regarding the clinical diagnosis of chest pain and the value of early thrombolysis. For all patients transported with a chief complaint of chest pain, they were asked to record an explicit diagnosis of "probable AMI" or "chest pain, other." Prehospital diagnoses were subsequently compared to ED diagnoses. Sensitivity, specificity and predictive values of the prehospital diagnosis for AMI were determined.

Results: During the 5-year study period, 1305 patients were studied. Based on clinical features alone, ALS paramedics were 77.8% sensitive and 82.2% specific for the diagnosis of AMI.

Conclusion: ALS paramedics can accurately identify patients likely to benefit from early aggressive AMI management. These data have implications with respect to prehospital triage of chest pain patients, "early notification" protocols and future prehospital thrombolytic strategies.

Key words: acute myocardial infarction; paramedics, Level III; paramedics, Level II; diagnosis, prehospital

RÉSUMÉ

Introduction : Les techniciens ambulanciers avertissent souvent le personnel de l'urgence à l'avance de la venue de victimes présumées d'un infarctus du myocarde pour qu'il prépare une prise en charge agressive et une thrombolyse rapide, mais la validité de cette pratique n'est pas claire. Notre objectif était de déterminer l'exactitude des diagnostics pré-hospitaliers d'infarctus du myocarde posés par des techniciens ambulanciers du Niveau III (SAR).

Méthodes : Les techniciens ambulanciers spécialisés en SAR desservant un hôpital communautaire achalandé reçurent des directives concernant le diagnostic clinique de la douleur thoracique et la valeur de la thrombolyse précoce. Pour tous les patients transportés dont la plainte principale était une douleur thoracique, on demanda aux techniciens de noter un diagnostic explicite de «infarctus probable» ou «douleur thoracique, autre». Les diagnostics pré-hospitaliers furent par la suite comparés aux diagnostics à l'urgence. La sensibilité, la spécificité et les valeurs prédictives du diagnostic pré-hospitalier pour l'infarctus du myocarde furent déterminées.

Résultats : Au cours d'une période d'étude de cinq ans, 1 305 patients furent évalués. À partir des paramètres cliniques seuls, les technicien ambulanciers avaient posé un diagnostic d'infarctus dont la sensibilité était de 77,8 % et la spécificité, de 82,2 %.

Conclusion : Les techniciens ambulanciers spécialisés en SAR peuvent identifier avec exactitude les patients susceptibles de bénéficier d'une prise en charge précoce et agressive de leur infarctus. Ces données ont des implications au niveau du triage pré-hospitalier des patients souffrant d'une douleur thoracique, des protocoles de «notification précoce» et des stratégies de thrombolyse pré-hospitalière futures.

*Chilliwack General Hospital, and Clinical Associate Professor, Department of Family Practice, University of British Columbia, Vancouver, BC
†Local Medical Coordinator, BC Ambulance Service, Chilliwack, BC

Received: July 3, 2001; final submission: Dec. 6, 2001; accepted: Dec. 15, 2001

This article has been peer reviewed.

Introduction

For patients with acute myocardial infarction (AMI), reducing delays to thrombolysis is critical.[1] If Paramedic Level III (ALS) attendants can accurately identify patients with AMI in the field, they can provide advance notice that will enable emergency department (ED) staff to "gear up" for aggressive management and rapid thrombolysis. In addition, the success of future prehospital thrombolytic strategies will depend largely on paramedics' ability to recognize patients with AMI. Our objective was to determine the accuracy of prehospital AMI diagnosis by ALS paramedics.

Methods

Setting

This 5-year prospective observational study was based at the Chilliwack General Hospital, Chilliwack, BC, which serves a mixed urban and rural population of 80 000 and manages 40 000 ED patient visits per year. In our region, ambulance staffing is determined by available manpower. Because of a shortage of ALS paramedics, ALS attendants were paired with other ALS attendants about half the time and with Paramedic Level II (EMA II) attendants the remainder of the time. A total of 9 ALS attendants staffed ambulances in our region during the study period. Of these, 7 participated for the entire duration of the study. All BC ambulance paramedics receive standard training from the Paramedic Academy of the Justice Institute of BC about chest pain and cardiac emergencies. Prior to study initiation, the paramedics involved in this study were given an additional educational session about the study, the diagnosis of chest pain and the value of early thrombolysis.

Patients and prehospital diagnosis

From Jan. 1, 1995, to Dec. 31, 1999, all patients with a chief complaint of chest pain transported to our hospital by ALS paramedics were eligible for study. At the time of each patient transport, paramedics were instructed to record an explicit diagnosis of "probable AMI" or "chest pain, other." The diagnosis of "probable AMI" was to be applied only when the diagnosis was indeed *probable* and not merely *possible*. Prehospital diagnoses were based on clinical findings, and prehospital 12-lead electrocardiography was not available. Diagnoses were recorded on the ambulance records, which were audited monthly and compared to the hospital chart for each patient. Feedback was provided on a monthly basis to each paramedic. The didactic session, the monthly audit and paramedic feedback were all provided by the same investigator throughout the duration of this study.

Hospital diagnosis

The ED diagnosis (AMI vs. no AMI) was the reference standard to which the prehospital diagnosis was compared. Patients were excluded if no prehospital diagnosis was specified, or if no diagnosis was specified on the hospital chart. Where the ED record was unclear, or when the ED diagnosis was nonspecific (e.g., "rule out MI" or "ischemic chest pain") then the diagnosis recorded on the initial consultant's report was used. To limit investigator bias, ED diagnosis was recorded by an investigator blinded to prehospital diagnosis.

Data analysis

Prehospital diagnosis was compared to hospital diagnosis. Sensitivity, specificity and predictive values were calculated, and 95% confidence intervals (CIs) were determined.

Results

During the 5-year study period, ALS crews transported 1342 patients with the chief complaint of chest pain to our hospital. Of these, 37 were excluded, primarily because no prehospital diagnosis was specified. The remaining 1305 patients were included in our study. Paramedics diagnosed "probable AMI" in 354 of these patients, of whom 158 had an ultimate diagnosis of AMI. Of 951 patients with a prehospital diagnosis of "chest pain, other," 45 subsequently received an ED diagnosis of AMI. Table 1 shows that sensitivity, specificity, positive predictive value and negative predictive value (with 95% CIs) of the prehospital diagnosis for AMI were 77.8% (95% CI, 72.1%–83.5%), 82.2% (95% CI 80.0%–84.4%), 44.6% (39.4%–49.8%) and 95.3% (93.9%–96.7%), respectively.

Of the 196 cases where ALS paramedics diagnosed AMI incorrectly, the ED diagnosis was angina in 84 cases, un-

Table 1. Comparison of prehospital diagnosis to emergency department diagnosis of patients with chest pain

	Emergency department diagnosis		
Prehospital diagnosis	AMI	No AMI	Total
AMI	158	196	354
No AMI	45	906	951
Total	203	1102	1305

AMI = acute myocardial infarction

https://doi.org/10.1017/S1481803500006424 Published online by Cambridge University Press

stable angina in 64 cases, chest pain of gastrointestinal origin in 8 cases, chest wall pain in 7 cases, chest pain not yet diagnosed (NYD) in 7 cases, dysrhythmia in 6 cases, and "other" (pneumonia, sepsis, dissection, cardiac syncope, pericarditis, and psychogenic chest pain) in 20 cases.

Discussion

The benefits of thrombolysis are time-dependent, and there is an ongoing search for strategies to reduce symptom-to-needle time. Prehospital telemetry of electrocardiograms (ECGs),[1] paramedic interpretation of electrocardiography performed before transport,[2,3] and prehospital thrombolysis have been studied,[4–6] but none of these strategies are in common use. It is standard practice, however, for paramedics to advise receiving hospitals of the imminent arrival of probable AMI patients. Despite this, we are not aware of previous studies assessing the potential utility of this practice. Our data suggest that ALS paramedics are able to identify patients likely to benefit from aggressive AMI management with sufficient accuracy to justify alerting the hospital's on-duty ECG technician, freeing up a monitored bed, opening the "clot box," and gearing up for expeditious management.

Limitations

Our study involved a small number of paramedics in one setting, and our findings may not be generalizable to all communities. They are probably relevant in settings where ALS paramedics have similar training and experience.

Emergency physician diagnostic accuracy is good but not perfect;[1] therefore, another potential limitation is our use of ED diagnosis as the diagnostic reference standard for AMI. Although we were aware of this limitation, we felt that the need for thrombolysis and early aggressive management is more closely related to ED diagnosis than to hospital discharge diagnosis, which often reflects information not available or relevant in the prehospital or ED phases of care.

Conclusion

ALS paramedics can accurately identify patients likely to benefit from early aggressive AMI management. These data have implications with respect to prehospital triage of chest pain patients, "early notification" protocols and future prehospital thrombolytic strategies.

Competing interests: None declared.

Acknowledgements: We thank Chilliwack General Hospital Librarian Rebecca Raworth for her literature searches and for obtaining the relevant medical literature for us. We are grateful to Dr. Jonathan Berkowitz for statistical analysis and manuscript review.

References

1. Kudenchuk PJ, Maynard C, Cobb LA, Wirkus M, Martin JS, Kennedy JW, et al. Utility of the prehospital electrocardiogram in diagnosing acute coronary syndromes: the Myocardial Infarction Triage and Intervention (MITI) Project. J Am Col Card 1998;32:17-27.

2. Millar-Craig MW, Joy AV, Adamowicz M, Furber R, Thomas B. Reduction in treatment delay by paramedic ECG diagnosis of myocardial infarction with direct CCU admission. Heart 1997;78:456-61.

3. Banerjee S. Fast-tracking of myocardial infarction by paramedics. J Royal Col Phys London 1998;32:36-8.

4. Morrison LJ, Verbeek PR, McDonald AC, Sawadsky BV, Cook DJ. Mortality and prehospital thrombolysis for acute myocardial infarction: a meta-analysis. JAMA 2000;283:2686-93.

5. Cannon CP, Sayah AJ, Walls R. ER TIMI-19: Testing the reality of prehospital thrombolysis. JEM 2000;19:21S-5S.

6. Myers R. Prehospital management of acute myocardial infarction: electrocardiogram acquisition and interpretation, and thrombolysis by prehospital care providers. Can J Cardiol 1998;14:1231-40.

Correspondence to: Dr. Howie Bright, 9123 Mary St., Chilliwack BC V2P 4H7; 604 795-9161, fax 604 795-9937, yhbbb@dowco.com