

A new chest pain strategy in Thunder Bay

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SUMMARY: Thunder Bay Regional Hospital (TBRH) developed a chest pain strategy (CPS) to support its emergency physicians in making the difficult clinical decisions required to properly evaluate and manage ED "chest pain" patients. This strategy was developed to ensure excellent patient care in a setting of diminished inpatient bed availability and increasing ED congestion. It focuses on rapid risk stratification, using history, electrocardiogram, physical examination and 3 new point-of-care cardiac markers: myoglobin, CK-MB mass, and cardiac troponin I.

Following the introduction of the CPS in 1997, TBRH realized significant (\$500 000/yr) institutional resource savings through a 60% decrease in the admission rate of non-myocardial infarction, non-unstable angina chest pain patients, a 30% decrease in ED chest pain evaluation time, and improved ED availability of monitored stretchers. The CPS has allowed TBRH to simultaneously decrease costs and improve patient care.

RÉSUMÉ : L'hôpital régional de Thunder Bay a mis sur pied une stratégie de traitement de la douleur thoracique afin d'aider les médecins d'urgence à prendre des décisions cliniques difficiles lors de l'évaluation et du traitement à l'urgence des patients accusant ce symptôme. Cette stratégie a été établie pour assurer les meilleurs soins aux patients dans un contexte où la disponibilité des lits diminue et la congestion des urgences augmente. Elle se concentre sur la classification rapide du risque basée sur les antécédents, l'électrocardiogramme, l'examen physique et trois nouveaux marqueurs cardiaques : la myoglobine, la CK-MB et la troponine I cardiaque.

À la suite de l'introduction de cette stratégie en 1997, l'hôpital de Thunder Bay a réalisé des économies importantes (500 000 \$/année) grâce à une diminution de 60 % du taux d'hospitalisation des patients dont la douleur thoracique n'était pas attribuable à un infarctus du myocarde ou à de l'angine instable, une diminution de 30 % du délai d'évaluation de la douleur thoracique à l'urgence et une plus grande disponibilité à l'urgence de civières sous monitoring. La stratégie a permis à l'hôpital régional de Thunder Bay de réaliser des économies tout en améliorant les soins aux patients.

In 1996, faced with the impending closure of several community hospitals, the Thunder Bay Regional Hospital (TBRH) administration and the hospital's emergency physicians feared that the new reality of diminished inpatient resources could expose chest pain patients and emergency physicians to increased risk. This concern prompted the development of an institutional chest pain strategy (CPS), with defined guidelines for chest pain evaluation and management. Following the introduction of the CPS in 1997, TBRH has

decreased chest pain admissions, shortened ED chest pain evaluation times, improved interdisciplinary (laboratory, cardiology and emergency) team functioning, and shown that investing in ED efficiency leads to institutional cost savings. This article describes this hospital's experience in the cooperative development, implementation and revision of a chest pain strategy that helped the hospital meet its patients' needs, support its emergency physicians' clinical decisions, and use limited resources efficiently.

Background

Every day, Canadian emergency physicians struggle to provide appropriate clinical evaluations for ED patients with chest pain. Few Canadian EDs have identified community standards or developed formalized strategies for chest pain evaluation. Consequently, wide practice variability exists. Emergency physicians' conservative approach to chest pain often leads to hospitalization or extended (9 to 24 hours) ED observation of low-risk patients.¹⁻³ In recent years, diminished

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health care funding has forced Canadian hospitals to reduce inpatient admissions and to struggle with severe ED overcrowding due to a backlog of admitted patients. Admissions for “chest pain NYD” or “rule-out MI” were more justifiable in the past; today, physicians often find that there are insufficient inpatient resources to support these conservative strategies. In this setting, the ability of any emergency physician to provide timely, quality care for even relatively simple clinical problems can be threatened and the appropriate ED evaluation of more complex cases such as the “chest pain” patient can be severely compromised. With ED overcrowding effectively precluding extended ED evaluations, how can we properly assess these “low-risk” patients without compromising patient care and increasing our liability exposure?

US literature suggests that chest pain units (CPUs), which conduct standard-

ized, extended evaluations of low-risk patients, can reduce unnecessary admissions and improve cost efficiency.^{4,5} Implementation of the CPU concept in Canadian hospitals has been limited, and, given the current environment of extreme fiscal restraint, the widespread establishment of these units may be neither feasible nor justifiable. Yet current resource limitations have created a pressing need for Canadian EDs to change their methods of evaluating low-risk chest pain patients. Bearing in mind that the literature estimates that we currently miss between 2% and 5% of patients with acute myocardial infarction (MI) with our traditional management model, accepting a lower standard of care is not a viable option.^{6,7}

Development of the strategy

In 1996 it became apparent at TBRH that our traditional approach to the eval-

uation of ED chest pain patients was no longer feasible in an increasingly resource-depleted environment. For this reason, the TBRH supported its emergency physicians in their attempt to define an efficient ED chest pain work up and disposition model that was consistent with available resources. In conjunction with the hospital's administration and the departments of cardiology and pathology/laboratory medicine, the ED spearheaded this effort.

After performing an extensive review of the current literature, it was recommended that the emergency physicians use a rapid risk stratification model to determine the feasibility and acceptance of the concept. The hospital financed a pilot project in which 3 new point-of-care (POC) cardiac markers (Spectral Diagnostics, Toronto) — myoglobin (myo), CK-MB mass (CK-MB), and cardiac troponin I (cTnI) — were introduced to the ED. These POC markers were incorporated into a rapid

Table 1. Guidelines. Risk stratification and disposition of patients seen in the Thunder Bay Regional Hospital Emergency Department with symptoms of possible cardiac ischemic origin

Group	Risk stratification				
	History	Electrocardiogram	Findings on physical examination	Cardiac markers	Disposition
I — AMI: Q wave and non-Q wave (highest risk)	Consistent, with acute coronary insufficiency	Abnormal, with or without acute ST elevation	Stable or unstable	Serial CK-MB elevated, positive 6-h cTnI	ICU, thrombolysis if candidate, heparin if non-Q-wave AMI
II — Unstable angina or “minimal myocardial damage” (high risk)	Consistent with unstable angina	Normal or abnormal, without acute ST elevation	Stable or unstable	Negative serial myoglobin/CK-MB (POC). cTnI may be positive or negative	Group IIa: ICU if unstable or cTnI positive Group IIb: Telemetry or “step down” if stable and cTnI negative
III — Chest pain possible stable angina (lower risk)	Suggestive of ischemic pain	No diagnostic changes	Normal	Negative serial myoglobin/CK-MB (POC) and 6-h cTnI (POC)	Arrange investigation and consultation as outpatient if satisfied with patient's clinical status and markers are negative
IV — Chest pain — rule out angina (low risk)	Equivocal history of pain	Normal	Normal	Negative serial myoglobin/CK-MB (POC) and cTnI (POC)	Arrange outpatient testing if satisfied with patient's clinical status
V — Chest pain, nonischemic (very low risk)	Equivocal	Normal	Possible alternate cause of pain identified	Negative (if done)	Any further testing arranged as outpatient

AMI = acute myocardial infarction, cTnI = cardiac troponin I, ICU = intensive care unit, POC = point of care.

risk stratification model.⁸⁻¹² By using these markers in the more rapid POC format, we attempted to provide expanded and more timely diagnostic information to support our emergency physicians in their decisions about risk stratification and disposition (Table 1). We anticipated that this might increase physician acceptance of the shift away from extended ED evaluation and hospitalization for low-risk patients (Groups III to V).¹³ At the completion of the 100-patient trial, the institution was satisfied with the potential of the rapid risk stratification model, and 75% of the emergency physicians expressed a desire to continue using the risk stratifi-

cation model and POC markers, provided that both initiatives were given formal institutional sanction.

As a result of the pilot project, the following goals of the CPS were identified.

1. To develop a guideline for the management of emergency patients with symptoms of possible cardiac ischemic origin (Table 1). To provide the emergency physician with clear guidance in matching a patient's risk stratification grouping (based on electrocardiogram [ECG], history, physical and cardiac marker results) with an associated risk

stratification management plan.⁸

2. To introduce new POC cardiac markers (myoglobin, CK-MB mass and cardiac troponin I) that would provide the physician with additional clinically useful and timely information. To develop a guideline for cardiac marker use and interpretation (Fig. 1).

Evaluation of the strategy

After its implementation in early 1997, the CPS was evaluated using two main outcome measurements: admission rates for "other" (non-MI, non-unstable angina) chest pain, and ED length of stay. We found that, after the introduction of the CPS, ED chest pain assessment times fell by 30% (from 4.7 h to 3.2 h), and 60% fewer "non-MI, non-unstable angina" patients were hospitalized. This equates to 375 patients annually in our 90 000 visits/yr ED. During this time the number of acute MIs and unstable angina admissions remained static. As a result, where we previously admitted 8 "other" chest pain patients for every 10 "MI or unstable angina" patients, this ratio has now fallen to 3:10.

More rapid patient evaluation has improved ED operation by increasing monitored bed availability, enhancing nursing efficiency, and improving patient flow. The institution has saved in excess of \$500 000/yr (net) by avoiding over 1000 inpatient days. For the hospital administration, implementing this strategy made "business sense." In effect, our CPS has achieved many of the savings associated with the development of a CPU, without the associated capital and operating costs.¹⁴

Since the implementation of the CPS, the percentage of patients discharged from the ED who were subsequently found to have "missed MI" or "unstable angina with progression to MI" has

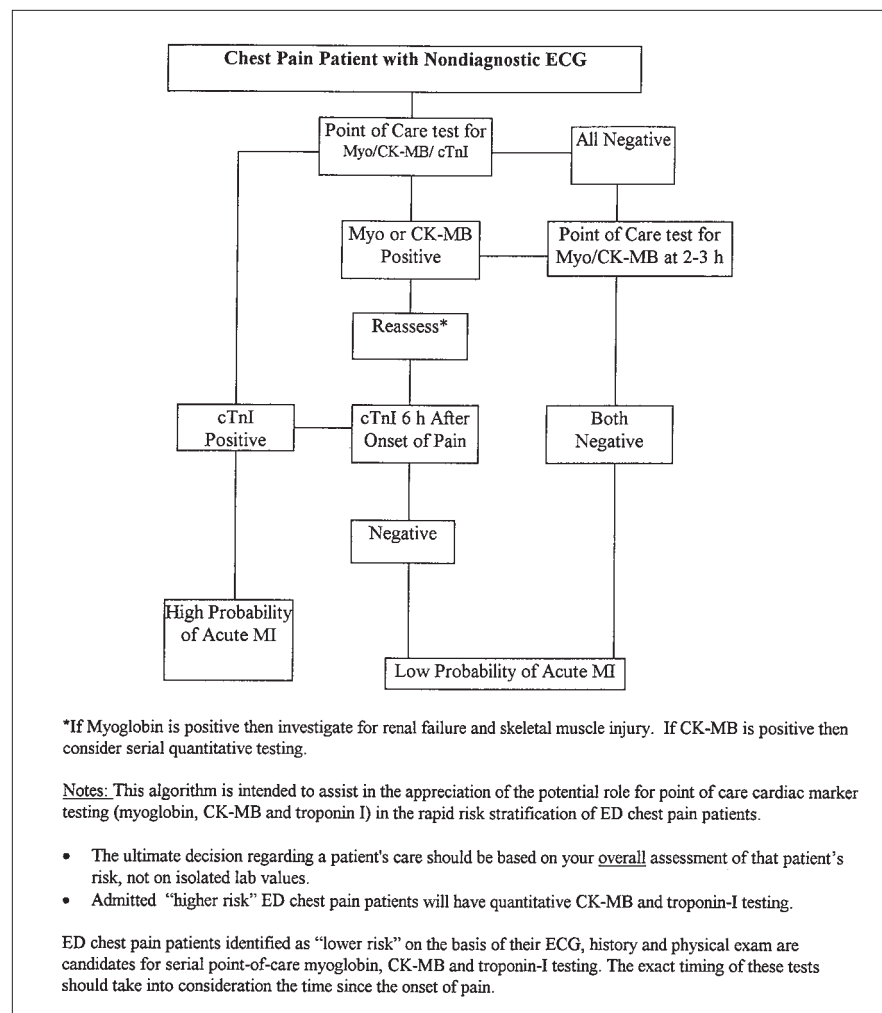


Fig. 1: Guidelines for cardiac marker utilization (Thunder Bay Regional Hospital Emergency Department, Thunder Bay, Ont.)

been less than 1%. Unfortunately, comparative data prior to the implementation of the CPS are not available.

Several other observations have been made following the implementation of the CPS. By defining it as an institutional strategy there has been a shift in the onus for outcome responsibility from being solely an individual emergency physician issue toward a sense of wider accountability with greater system support for physicians exercising their clinical judgement. In addition, as a result of working through this process with the departments of cardiology and pathology/laboratory medicine, there has developed a genuine understanding of our common issues and the expectations our respective groups have of one another. But perhaps the greatest surprise following 2 years of working with the CPS is the willingness and ease with which all parties are amenable to revision of the strategy to accommodate new research or institutional resources, such as expanded quantitative cardiac marker testing.

Summary

The development of the CPS has provided our emergency physicians with the option of using community-defined guidelines that enhance the ED management of chest pain for the physician, the patient and the hospital. Since the implementation of the TBRH chest pain strategy there has been a dramatic shift in physician practice, which demonstrates that limited resources can be used efficiently to provide timely data in a framework that supports emergency physicians who exercise their clinical judgement. Although the CPS was developed for our community, other emergency physicians and patients may benefit from developing a community CPS that reflects their reality of available resources.

Objectives

1. To assist in the rapid assessment and risk stratification of the acute chest pain/cardiac ischemia patient (symptoms < 12 hours) within the emergency department.
2. To ensure that those patients requiring inpatient management (acute MI and unstable angina) receive prompt admission and appropriate treatment within 30 minutes.
3. To ensure that those patients suitable for outpatient management are identified and that timely pre-discharge arrangements are made for their continued investigation.

Note: The intent of this guideline is to assist emergency physicians in exercising their clinical judgement in the management of the undifferentiated chest pain patient. Not all patients will fit neatly into these groupings. The guideline is intended to supplement individual clinical judgement in determining patient disposition.

References

1. Finberg H, Scadden D, Goldman I. Care of patients with a low probability of acute myocardial infarction: cost effectiveness of alternatives to coronary care admission. *N Engl J Med* 1984;310:1301-7.
2. Weingarten SR, Ermann B, Riedinger MS, Shah PK, Ellrodt AG. Selecting the best triage rules for patients hospitalized with chest pain. *Am J Med* 1989;318:787-803.
3. Lee TH, Juarez G, Cook EF, Weisberg MC, Rouan GW, Brand DA, et al. Ruling out myocardial infarction: a prospective multicentre validation of a 12-hour strategy for patients at low risk. *N Engl J Med* 1991;324:1239-46.
4. Roberts RR, Zalenski RJ, Mensah EK, Rydman RJ, Ciavarella G, Gussow L, et al. Costs of an emergency department-based accelerated diagnostic protocol vs hospitalization in patients with chest pain. *JAMA* 1995;278:1670-6.
5. Bahr R. Growth in chest pain emergency departments throughout the United States: a cardiologist's spin on solving the heart attack problem. *Coron Artery Dis* 1995;6:827-30.
6. McCarthy B, Beshansky J, D'Agostino R, et al. Missed diagnosis of acute myocardial infarction in the emergency department: results from a multicenter study. *Ann Emerg Med* 1993;22:579-82.
7. Puleo PR, Meyer D, Wathen C, Tawa CB, Wheeler S, Hamburg RJ, et al. Use of a rapid assay of subforms of creatine kinase MB to rule out acute myocardial infarction. *N Engl J Med* 1994;331:561-6.
8. Tatum JL, Jesse RL, Kontos MC, Nicholson CS, Schmidt KL, Roberts CS, et al. Comprehensive strategy for the evaluation and triage of the chest pain patient. *Ann Emerg Med* 1997;29:116-25.
9. Gornall D, Roth S. Serial myoglobin quantitation in the early assessment of myocardial damage: a clinical study. *Clin Biochem* 1996;29:379-84.
10. Winter R, Koster R, Sturk A, Sanders G. Value of myoglobin, troponin T and CPK-MB (mass) in ruling out acute myocardial infarction in the emergency room. *Circulation* 1995;92:3401-7.
11. Antman EM, Tanasijevic MJ, Thompson B, Schactman M, McCabe CH, Cannon CP, et al. Cardiac-specific troponin I levels to predict the risk of mortality in patients with acute coronary syndromes. *N Engl J Med* 1996;335:1342-9.
12. Keffer J. The cardiac profile and proposed practice guideline for acute ischemic heart disease. *Am J Clin Path* 1997;107:398-409.
13. Hamm CW, Goldmann BU, Heeschen C, Kreyman G, Berger J, Meinertz T. Emergency room triage of patients with acute chest pain by means of rapid testing for cardiac troponin T or troponin I. *N Engl J Med* 1997;337:1648-53.
14. Gaspoz JM, Lee TH, Weinstein MC, Cook EF, Goldman P, Komaroff AL, et al. Cost-effectiveness of a new short-stay unit to "rule out" acute myocardial infarction in low risk patients. *J Am Coll Cardiol* 1994;24:1249-55.

Section Editors' note: This article raises some current controversies regarding our current health care system. The administrative responses to perceived problems and the application of social science reasoning to complex, multifactorial issues is increasingly prevalent across the country. As this article stands, there are a number of details missing that are needed to support the author's conclusions. However, it seems clear that emergency physicians are trying to better quantify and qualify what we do in the ED.

The initial few paragraphs highlight a problem we face in the ED — shrinking resources (both money and people). The response by individuals and institutions of developing guidelines, strategies, or policies is interesting. Are the guidelines based on well-conducted studies, or on methodologically flawed “evidence”? Are they developed to summarize best medical practice, or are they the result of administrative and financial imperatives?

One may well ask Why was this strategy developed now? Was the objective to improve health care delivery, or was there an administrative directive? How was the working group formed? How did it function? Why was the “traditional” approach to assessing chest pain patients not working? What was the traditional approach? Is the new strategy a departure from what most EDs do, or is it merely formalizing an approach with “buy-in” from consulting services and administration? Is it possible that CPUs have not caught on in Canada because they do not save that much money? Some suggest that CPUs are a clever marketing tool to draw patients to private US hospitals.

The article, unfortunately, does not outline pre- and post-CPS admission rates, costs, etc. It is difficult to know if the “missed MI” rate is truly less than 1% because the article does not indicate

how, or whether, chest pain patients were followed up after discharge. Nor does the author indicate what the “missed MI” rate was before the CPS. How were the dollar savings for the hospital calculated? For hospitals to save or re-direct money, other services must expand, or beds must be closed and job attrition occur. Did this happen?

Evidence-based medicine is progressively influencing the practice of emergency medicine. There is still much inefficiency in our daily practices. It is important, however, that we try to evaluate our programs scientifically and avoid assumptions of cause and effect. A change in outcome may not be the direct result of a change in practice. We are the “gatekeepers” between community and expensive care. A new guideline, strategy or protocol may create a false sense of security while actually increasing medicolegal liability or workload. When seeking to improve our practice we must remember to critically appraise not only the literature but also those around us who offer to “help” us with our practice.[J.S., J.R.]

Editor's note: Evaluating patients with chest pain is difficult, hazardous and stressful work — even more so in “resource-depleted” Canadian hospitals. We are all looking for solutions, and Dr. Mutrie describes the efforts made in one busy Canadian ED.

According to the information presented, the TBRH chest pain strategy provided an organized approach to chest pain, reduced the number of unnecessary admissions, shortened ED lengths of stay, improved ED patient flow and enhanced inter-departmental cooperation. All of these are good things. Readers must, however, be cautious about generalizing these apparent benefits beyond the Thunder Bay setting.

Mutrie seems to look favourably on the US chest pain unit model. This approach involves prolonged ED observation and intensive investigation of many “low-risk” chest pain patients who, in Canada, would be discharged from the ED after limited testing. Wide adoption of this strategy would reduce costs for those without ischemic heart disease who are currently admitted to coronary care units, but would increase costs for many more.

The TBRH strategy also depends heavily on point-of-care cardiac marker testing. The scientific basis for this is weak. Cardiac marker sensitivity is not adequate at 6 hours to rule out myocardial infarction, let alone unstable angina. Physicians should not be reassured by relatively insensitive tests; nor should they confuse negative predictive value for sensitivity when reading published reports of test utility. And while the thought of “instant” diagnostic tests is pleasing to many, in “grey zone” patients who may be evolving a myocardial infarction, our most valuable test is the ability to perform clinical reassessments and repeat ECGs over time; therefore, the added value of an “instant” blood test seems limited.

I am concerned that the success of the TBRH chest pain strategy was evaluated based on admission rate and ED lengths of stay when the true, critical marker of success is patient outcome. (It is unclear how, or if, this was assessed in Thunder Bay.) In addition, the estimate of cost saving (\$500 000) is interesting. It is based on 375 fewer admissions and 1000 fewer hospital days. If low-risk patients, with neither unstable angina nor MI, who can now be discharged safely from the ED, are normally admitted for an average of 2.7 days (1000/375), then there are much larger utilization issues to deal with at the TBRH. [G.I.]