

# Treating the right patient at the right time: Access to care in non-ST segment elevation acute coronary syndromes

BJ O'Neill MD<sup>1</sup>, JM Brophy MD<sup>2</sup>, CS Simpson MD<sup>3</sup>, MM Sholdice BA MBA<sup>4</sup>, M Knutson MD<sup>5</sup>,  
DB Ross MD<sup>6</sup>, H Ross MD<sup>7</sup>, J Rottger MD<sup>8</sup>, Kevin Glasgow MD<sup>9</sup>,  
for the Canadian Cardiovascular Society Access to Care Working Group\*

BJ O'Neill, JM Brophy, CS Simpson, et al, for the Canadian Cardiovascular Society Access to Care Working Group. Treating the right patient at the right time: Access to care in non-ST segment elevation acute coronary syndromes. *Can J Cardiol* 2005;21(13):1149-1155.

In 2004, the Canadian Cardiovascular Society formed an Access to Care Working Group with a mandate to use the best science and information available to establish reasonable triage categories and safe wait times for common cardiovascular services and procedures through a series of commentaries. The present commentary discusses the rationale for access benchmarks for urgent cardiac catheterization and revascularization, including hospital transfer in the setting of non-ST elevation acute coronary syndromes. The literature on standards of care, wait times, wait list management and clinical trials was reviewed. A survey of all cardiac catheterization directors in Canada was performed to develop an inventory of current practices in identifying and triaging patients. The Working Group recommended the following medically acceptable wait times for access to diagnostic catheterization and revascularization in patients presenting with acute coronary syndromes: for diagnostic catheterization and percutaneous coronary intervention, the target should be 24 h to 48 h for high-risk, three to five days for intermediate-risk and five to seven days for low-risk patients; for coronary artery bypass graft surgery, the target should be three to five days for high-risk, two to three weeks for intermediate-risk and six weeks for low-risk patients. All stakeholders must affirm the appropriateness of these standards and work continuously to achieve them. However, some questions remain around what are the best clinical risk markers to delineate the triage categories and the utility of clinical risk scores to assist clinicians in triaging patients for invasive therapies.

**Key Words:** Access to care; Acute coronary syndromes; Myocardial infarction; Wait lists

The Canadian Cardiovascular Society (CCS) is the national professional society for cardiovascular specialists and researchers in Canada. In 2002, at the Canadian Cardiovascular Congress Public Policy Session, Senator Wilbert Keon stated that an important role of a national professional organization, such as the CCS, would be to develop national standards for access to cardiovascular care that could be validated and adopted or adapted by the provinces. Further,

## Traiter le bon patient au bon moment : L'accès aux soins en cas de syndromes coronariens aigus sans surélévation du segment ST

En 2004, la Société canadienne de cardiologie a formé un groupe de travail d'accès aux soins mandaté à utiliser les meilleures données scientifiques et la meilleure information disponibles pour fixer des catégories de triage raisonnables et des listes d'attente sécuritaires en vue d'obtenir des services et interventions courants en santé cardiovasculaire, au moyen d'une série de commentaires. Le présent commentaire porte sur la justification d'établir des points de référence pour l'accès à un cathétérisme cardiaque et à une revascularisation d'urgence, y compris un transfert hospitalier en cas de syndromes coronariens aigus sans surélévation du segment ST. Les publications sur les normes de soins, les temps d'attente, la prise en charge des listes d'attente et les essais cliniques ont été analysés. Un sondage auprès de tous les directeurs du cathétérisme cardiaque au Canada a été envoyé afin d'obtenir l'inventaire des pratiques courantes pour repérer et trier les patients. Le groupe de travail a recommandé les temps d'attente médicalement acceptables suivants pour que les patients atteints de syndromes coronariens aigus aient accès à un cathétérisme cardiaque diagnostique et à une revascularisation : En cas de cathétérisme diagnostique et d'intervention coronaire percutanée, l'objectif devrait être de 24 heures à 48 heures pour les patients très vulnérables, de trois à cinq jours pour les patients moyennement vulnérables et de cinq à sept jours pour les patients peu vulnérables, tandis qu'en cas de pontage aortocoronarien, l'objectif devrait être de trois à cinq jours en présence d'un risque élevé, de deux à trois semaines en présence d'un risque moyen et de six semaines en présence d'un faible risque. Tous les intervenants doivent confirmer la pertinence de ces normes et constamment chercher à les respecter. Cependant, certaines questions demeurent au sujet de ce qui représente les meilleurs indicateurs de risque clinique pour délimiter les catégories de triage et l'utilité des indices de risque clinique afin d'aider les cliniciens à trier les patients en prévision d'une thérapie efficace.

he noted that this was the right time for such initiatives, given that policy-makers and the health care system are grappling with access and waiting time issues.

A professional organization such as the CCS, with its broad-based membership of cardiovascular experts, is ideally positioned to initiate a national discussion and commentary on appropriate standards for access to care for cardiovascular services and procedures. In spring 2004, the CCS Council formed an Access to

<sup>1</sup>Department of Medicine, Division of Cardiology, Dalhousie University, Halifax, Nova Scotia; <sup>2</sup>Division of Cardiology, McGill University Health Centre, McGill University, Montreal, Quebec; <sup>3</sup>Department of Medicine, Division of Cardiology, Queen's University, Kingston; <sup>4</sup>Canadian Cardiovascular Society, Ottawa, Ontario; <sup>5</sup>Department of Cardiac Sciences, Libin Cardiovascular Institute of Alberta, University of Calgary, Calgary; <sup>6</sup>Department of Surgery, University of Alberta, Edmonton, Alberta; <sup>7</sup>Department of Medicine, Division of Cardiology, University Health Network, University of Toronto, Toronto, Ontario; <sup>8</sup>Rural Primary Care Physician, Pincher Creek, Alberta; <sup>9</sup>Cardiac Care Network of Ontario

\*The views expressed herein do not necessarily reflect official positions of the indicated affiliate organizations

Correspondence: Dr BJ O'Neill, Rm 2134-1796 Summer Street, Queen Elizabeth II Health Sciences Centre, Halifax, Nova Scotia B3H 3A7.

E-mail boneill@dal.ca

Received for publication May 3, 2005. Accepted May 26, 2005

**TABLE 1**  
**Canadian Cardiovascular Society Access to Care Working Group definitions**

Term	Definition
Wait time	For consultations, the time elapsed between referral by the family physician and the first consult with the specialist; for diagnostic tests, the time elapsed between decision to delivery of service; for therapeutic procedures (including surgeries), the time elapsed between the decision to treat and the procedure.
Wait time indicator	Standardized measure of wait time for a given health service that is comparable across jurisdictions and provides an accurate picture of wait times for a cohort of patients.
Medically acceptable wait time standard	Threshold wait time for a given health service and level of severity beyond which the best available evidence and clinical consensus indicate that patient health is likely to be adversely affected. Such guidelines are intended to supplement, not replace, the physician's clinical judgment.
Wait time target	A target wait time for a given health service that may be equal to or exceed the medically acceptable wait time for a given proportion of patients. A wait time target is in effect for a given period of time and is a step along the continuum to achieving the medically acceptable wait time for all patients.
Urgency	The extent to which immediate clinical action is required based on the severity of the patient's condition and considerations of expected benefit.
Urgency rating score	A score based on the clinical description of an individual patient's condition to determine the urgency for care.

Care Working Group with a mandate to use the best science and information available to establish reasonable triage categories and safe wait times for access to common cardiovascular services and procedures through a series of commentaries.

These commentaries will summarize the current variability of standards and wait times across Canada, where this information is available. They will also summarize the available data, particularly focusing on the relationship between the risk of an adverse event and the wait time, and identify gaps in existing data. By using best evidence and expert consensus, each commentary will take an initial position on what the optimal standard for access to care ought to be for the cardiovascular service or procedure. Each commentary will be a first step in developing national targets by creating a summary of the available data and by calling on cardiovascular researchers to take action to fill the gaps in this body of knowledge.

The terms used by the Access to Care Working Group are defined in Table 1.

The Access to Care Working Group decided to select non-ST elevation acute coronary syndromes (NSTEMI), and, in particular, access to urgent cardiac catheterization and revascularization, as the subject of one of its commentaries. The reason for choosing NSTEMI was that it is one of the most common causes of hospitalization, and several recent large randomized trials have been published reporting the benefit of early access to cardiac catheterization and revascularization for patients. In addition, Canada's centralized cardiac catheterization facilities system means that if more patients are to be transferred for catheterization and revascularization, then any administrative and organizational hurdles to this delivery of optimal care must be identified and addressed.

#### REVIEW OF THE LITERATURE AND A NATIONWIDE SURVEY OF ACCESS AND ACCESS STANDARDS

The Working Group conducted a review to identify published literature on the issues surrounding access to care for revascularization procedures, including standards of care, wait times, wait list management and clinical trials. The review included searches on PREMEDLINE, MEDLINE, EMBASE and HealthSTAR covering North America, Europe and Australia from 1995 to 2004.

The Working Group also surveyed all cardiac catheterization directors in Canada to develop an inventory of current practices in identifying and triaging patients. Each centre was also asked to provide its wait lists for hospital transfers, diagnostic cardiac catheterization, percutaneous coronary intervention (PCI) and coronary artery bypass graft (CABG) surgery, and to provide their target wait times for these procedures if they existed.

#### ACCESS TO EARLY CARDIAC CATHETERIZATION

Traditionally, prioritization for access to revascularization has used functional testing or anatomical subsets determined by coronary angiography and has largely focused on access to cardiac surgery to determine medically acceptable wait times (1,2). In Canada, procedural capacity is concentrated in regional referral centres. This poses a challenge to timely revascularization for a large proportion of the Canadian population. Many reports have shown a clear relationship between the supply of diagnostic cardiac catheterization facilities and the likelihood of undergoing cardiac catheterization (2,3). For instance, admission to an invasive hospital and geographical proximity to cardiac catheterization facilities are important factors in determining the likelihood of undergoing an invasive cardiac procedure (3). Even in the United States, the relationship between the supply and geographical proximity of cardiac catheterization laboratories is closely correlated to per capita cardiac catheterization rates and revascularization rates (4,5). In addition, in the United States, where access to cardiac catheterization laboratories is much greater, the CRUSADE Registry has shown that only two-thirds of patients with ST-segment depression or positive biochemical markers undergo cardiac catheterization, and fewer than one-half of these catheterizations are performed within 48 h (6). Patients who underwent early catheterization were younger, more of them were male and white, and they were more likely to be admitted to a subspecialty cardiology service and less likely to have heart failure or renal insufficiency. Thus, low-risk patients are often preferentially selected for intervention rather than those at higher risk, who would be the most likely to benefit. This phenomenon has previously been observed in the selection of patients for revascularization following thrombolysis for acute myocardial infarction (MI) (7).

**TABLE 2**  
Recent trials regarding aggressive management in non-ST elevation acute coronary syndromes

Study	ISAR-COOL (n=410)		VINO (n=131)		FRISC II (n=2457)		TACTICS-TIMI 18 (n=2220)		RITA-3 (n=1810)	
Setting	Two German centres		Single centre, Czech Republic		Multicentre, Scandinavia		Multicentre, North America		Multicentre, United Kingdom	
One-year event rate (%)	5.9*	11.6*	6.3†	22.4†	9.4‡	12.1‡	7.3§	9.5§	7.6¶	8.3¶
Cath target	<6 h	3–5 d	<24 h	Rest pain	<7 d	Rest pain	<48 h	Rest pain	<72h	Rest pain
PCI target	<6 h		<24 h	ECG changes	<7 d	ECG changes	<48 h	ECG changes		ECG changes
CABG target			21–28 d	+ GXT	<10 d	+ GXT		+ GXT		+ GXT
Median time to cath	2.4 h	86 h	6.2 h	61 d	4 d (2–6)	17 d (6–132)	22 h	50 h	2 d	
% angio ≤ target	88	0	Not stated	Not stated	96	10	97	51	97	16
Time to PCI	NS	NS	8.6 h	55 d	4 d (2–7)	17 d (5–132)	25 h	93 h	3 d	
% PCI ≤ target	NS	NS	47	3	94	20	41	24	35	7
Time to CABG	NS	NS	34 d	86 d	7 d (5–13)	28 d (10–139)	89 h	144 h	22 d	
% CABG ≤ target	NS	NS	Not stated	Not stated	82	13	20	13	12	4

For each study, the first column shows the results for the aggressive treatment arm of the named trial and the second column shows the delayed or more conservative treatment arm. The end points varied among the studies: \*30-day death and nonfatal myocardial infarction (MI) event rate; †Six-month death and nonfatal MI event rate; ‡Death and nonfatal MI event rate; §Six-month death, nonfatal MI event rate and hospitalization for unstable angina; ¶Death, nonfatal MI or refractory angina at four months. Angio Angiography; CABG Coronary artery bypass graft; Cath Catheterization; ECG Electrocardiograph; FRISC II Fragmin and fast Revascularization during InStability in Coronary artery disease trial; GXT Graded exercise test; ISAR-COOL Intracoronary Stenting with Antithrombotic Regimen Cooling-Off study; NS Not stated; PCI Percutaneous coronary intervention; RITA-3 Randomized Intervention Trial of unstable Angina; TACTICS-TIMI 18 Treat Angina with Aggrastat and Determine Cost of Therapy with an Invasive or Conservative Strategy-Thrombolysis in Myocardial Infarction 18; VINO Value of First Day Angiography/Angioplasty In Evolving Non-ST Segment Elevation Myocardial Infarction: An Open Multicenter Randomized Trial

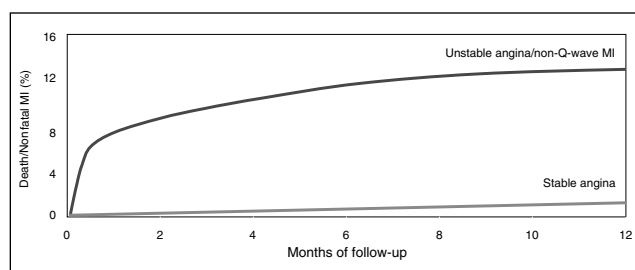
In the United Kingdom, an ‘inverse care law’ often is associated with locations that are geographically remote from cardiac catheterization centres (2,3,8-10). The inverse care law refers to decreased regional access with increasing distance to cardiac catheterization and bypass surgery centres. This is often despite the fact that these remote districts often have higher disease burdens than the districts closer to the cardiac catheterization facilities.

In the United Kingdom, at least for stable angina, access to specialists, particularly interventionalists, and patients’ attitudes about the likelihood that they will benefit from invasive investigation are the main factors decreasing referral from areas geographically remote from the invasive regional hospital. Certainly, in Canada, patients admitted to hospitals with invasive facilities are far more likely to undergo cardiac catheterization than are those admitted to institutions with no cardiac catheterization facilities (11). Although there were no differences in ‘hard’ end points, such as death or MI, Alter et al (11) have shown large differences in time to revascularization (12 days for those admitted to an invasive hospital versus 48 days for those who were not) resulting in fewer readmissions and fewer hospital bed days.

### HAZARD OF QUEUING FOR REVASCULARIZATION

Stable angina has a very low event rate over time (12). On the other hand, many registries of patients with acute coronary syndromes (ACS) have shown a very large early hazard that levels off after three months (13-15). Figure 1 shows the typical differences in event rates between patients with an ACS and those with stable angina. It is this early hazard that prompted investigators to investigate the potential utility of routine early intervention in NSTEACS.

Many reports have analyzed the events on the wait lists for cardiac surgery, but far fewer have examined the risks of delay for PCI (16-24). Events on the surgical queue tend to occur unpredictably and often within the first 30 days after being placed in the queue. Most of these reports suggest a 1% to 2% mortality, a 3% to 4% risk of nonfatal MI and a 20% to 25%

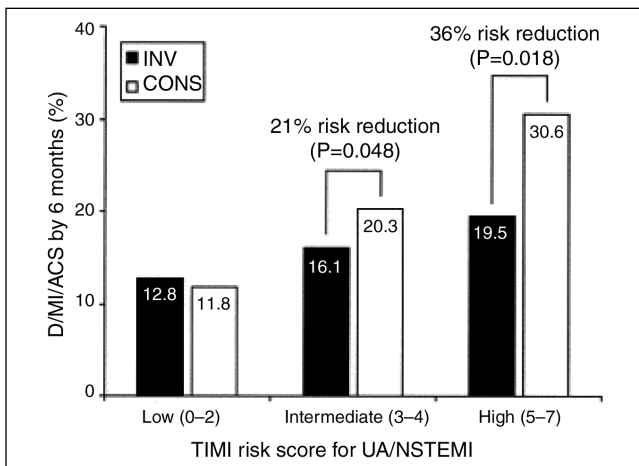


**Figure 1** Differences in event rates between patients with an acute coronary syndrome and patients with stable angina. MI Myocardial infarction. Data from references 12 and 13

risk of rehospitalization with a cardiac event. Predictors of events in these reports include increasing age, low ejection fraction, higher angina or heart failure class, or clinical diagnosis of unstable angina. At least two series show that when left ventricular (LV) ejection fraction is severely reduced and there is evidence of viable myocardium, waiting longer than 30 days for cardiac surgery results in much greater mortality and much less recovery of LV function (25,26). This is important in this population because several registries have suggested that the presence of heart failure is associated with less likelihood of undergoing cardiac catheterization (27).

### SUMMARY OF TRIALS OF ROUTINE EARLY INVASIVE MANAGEMENT

Earlier trials of more aggressive management in NSTEACS failed to show a clear benefit of a routine early invasive strategy (28,29). More recent trials are shown in Table 2 (30-34). Although these more recent trials have some methodological problems (eg, the Fragmin and fast Revascularization during InStability in Coronary artery disease [FRISC II] trial required 3 mm ST depression to cross over from the usual intervention to the aggressive early intervention arm), these trials have shown a consistent reduction in the risk of nonfatal MI and rehospitalization with acute coronary events, perhaps due to recent improvements in interventional techniques and adjunctive therapies.



**Figure 2)** Gradient of benefit observed in the Treat Angina with Aggrastat and Determine Cost of Therapy with an Invasive or Conservative Strategy-Thrombolysis in Myocardial Infarction 18 (TACTICS-TIMI 18) study with an early invasive strategy depending on TIMI risk score. ACS Acute coronary syndromes; CONS Conservative; D Death; INV Invasive; MI Myocardial infarction; NSTEMI Non-ST elevation myocardial infarction; UA Unstable angina

Target times to revascularization in these trials may assist in establishing triage standards for access to these strategies in Canada. Targets times to revascularization have been as short as 6 h in the Intracoronary Stenting with Antithrombotic Regimen Cooling-Off (ISAR-COOL) study and as long as seven days in the FRISC II trial. The median time to PCI was 8.6 h in the Value of First Day Angiography/Angioplasty In Evolving Non-ST Segment Elevation Myocardial Infarction: An Open Multicenter Randomized Trial (VINO) study, 25 h in the Treat Angina with Aggrastat and Determine Cost of Therapy with an Invasive or Conservative Strategy-Thrombolysis in Myocardial Infarction 18 (TACTICS-TIMI 18) study, three days in the Randomized Intervention Trial of unstable Angina (RITA)-3 and four days in the FRISC II trial. Target times to CABG in the early aggressive strategy varied from as short as less than 90 h in the TACTICS-TIMI 18 study and seven days in the FRISC II trial, to as long as 22 days in RITA-3 and 34 days in the VINO study. Those who underwent an early revascularization strategy within 48 h in the United States CRUSADE Registry also had a significant reduction in death and MI (6).

#### POTENTIAL ROLE OF CLINICAL RISK SCORES

Within the early invasive strategy, there is a gradient of benefit determined by the magnitude of risk factors for adverse outcomes such that identifying high-risk patients should be a clinical priority (35). Figure 2 indicates the gradient of benefit observed in the TACTICS-TIMI 18 study with an early invasive strategy depending on the TIMI risk score. Thus, the benefits of an early invasive strategy are greatest in patients at the highest risk. The benefits persist in intermediate-risk patients but with less absolute and relative risk reductions. However, a routine early invasive strategy offers little advantage in terms of mortality or nonfatal infarction in those in the lowest risk categories.

In addition to the trials of early routine intervention, several other trials of medical interventions outline the risk factors that indicate the patients at greatest risk of an adverse

**TABLE 3**  
**Risks of adverse outcomes**

#### Recommendations for risk stratification

Risk assessment should be precise, reliable and, preferably, easily and rapidly available at low cost. The following methods are recommended:

- A Markers of thrombotic risk (ie, acute risk)
  - Recurrence of chest pain
  - ST-segment depression
  - Dynamic ST-segment changes
  - Elevated concentration of cardiac troponins
  - Thrombus on angiography (known only after angiography)
- B Markers of underlying disease (ie, long-term risk)
  - B1 Clinical markers
    - Age
    - History of previous myocardial infarction, coronary artery bypass graft surgery, diabetes, congestive heart failure, hypertension
  - B2 Biological markers
    - Renal dysfunction (elevated creatinine or reduced creatinine clearance)
    - Inflammatory markers, C-reactive protein elevation, fibrinogen elevation (not widely available at this time)
  - B3 Angiographic markers
    - Left ventricular dysfunction
    - Extent of coronary artery disease

Level evidence for all markers: A

Adapted from reference 37

outcome (36). Table 3 provides an easily applied and understood list of risks (37). Subdividing risks according to the likely underlying pathophysiology helps to define those patients who would likely benefit from earlier, more timely intervention because of a high thrombotic risk versus those who would likely benefit from revascularization in an intermediate time frame because of disease burden.

Several clinical risk scores have been developed to help clinicians quickly define the risk of patients under their care (35,38,39). Such clinical risk scores are able to identify patients with a higher probability of impaired LV function, greater angiographic extent of coronary artery disease or thrombus burden. However, few studies have directly validated the application of clinical risk scores to clinical practice guidelines or, for instance, to assist in decision-making around selection and timing of transfer to tertiary cardiac care centres (40). This would be useful to study systematically.

Arguably, the most useful clinical risk score available to clinicians is the TIMI risk score, optimized to predict death, recurrent MI and recurrent ischemia, and now available as a downloadable file for hand-held pocket organizers (35). The TIMI risk score takes into account seven clinical variables, as shown in Table 4. The TIMI risk score can be complemented by several cues, such as spontaneous or provokable chest pain, particularly with ST-segment shifts, evidence of heart failure or hypotension. In addition, use of a computerized risk score may allow the development of objective means to evaluate the triage category and whether medically acceptable wait times adjusted to the risk of the patient are being met.

#### SURVEY OF ACCESS FOR PATIENTS WITH ACS

The Working Group sent a survey to all catheterization laboratory directors in Canada to collect data on wait time

standards and performance against these standards. Twenty-two of 39 laboratories responded to the survey, for a response rate of 56%. Responses were received from centres in every province that have advanced cardiac services and from many of the largest centres in Canada.

The survey responses showed that there are no consistent definitions for urgency, making it difficult to compare access to revascularization services across jurisdictions and impossible to make generalizations across Canada. Outside of Ontario and Quebec, only a few of the larger centres regularly collect and report wait time data. Only three centres reported that they have wait time standards for patients being transferred from another hospital.

Most centres reported that they recognize the urgency associated with patients with ACS, assign an appropriate priority through a formal or informal triage process, and provide the needed diagnostic and therapeutic services for this patient population on a timely basis. In general, patients with ACS are given a higher priority for access to procedures on the basis of any of the following factors:

- The urgency ratings recognize ACS as an urgent condition (eg, Quebec's *Système de gestion de l'accès aux services* recognizes this indication explicitly).
- Patients with ACS are often inpatients, and inpatients typically have a higher priority for these procedures.
- Informal triage processes that rely on physician judgement generally recognize the urgency for patients with ACS. For example, some centres allocate the 'next available slot' to patients with ACS needing a procedure.
- There was little evidence that any centre risk-stratifies patients for urgency of transfer, or that centres formally track transfer wait times or have systems to ensure appropriate triage of patients with NSTEMACS from their catchment area.

#### ACCESS TO CARE WORKING GROUP RECOMMENDATIONS FOR MEDICALLY ACCEPTABLE WAIT TIMES FOR ACCESS FOR PATIENTS WITH ACS

On the basis of its review of the literature and the cross-Canada survey, the CCS Access to Care Working Group advocates the development of national standards for formal risk stratification and timely access to diagnostic cardiac catheterization and revascularization. Each jurisdiction will have to develop provincial, territorial or regional management plans for patients with ACS that will, for instance, include navigation plans. Centres with invasive facilities should develop standards for access to revascularization for patients in their catchment area. These should be supported and endorsed by providers, institutional or health authority administrations and boards, and provincial and territorial ministries of health. Adherence to these standards should be regularly reported to those responsible for delivery of care, as well as to the general public as a report card. To assure that the highest risk patients are referred in a more timely fashion than lower risk patients, a clinical practice guideline, with a built-in urgency risk score, should be developed. This would allow family doctors and generalists caring for these patients to use the guideline to reduce variability in referral. Ideally, computerized triage scores would

**TABLE 4**  
**Seven clinical variables of the Thrombolysis in Myocardial Infarction (TIMI) risk score**

Characteristic	Points
Historical	
Age $\geq 65$ years	1
$\geq 3$ risk factors for coronary artery disease	1
Known coronary artery disease (stenosis $\geq 50\%$ )	1
Acetylsalicylic acid use in past seven days	1
Presentation	
Recent ( $\leq 24$ h) severe angina	1
ST-segment deviation $\geq 0.5$ mm	1
Increase in cardiac markers	1
Risk score = total points	(0–7)

help referring physicians identify intermediate- and high-risk patients and help tertiary care centres triage them in an appropriately risk-adjusted queue.

Invasive centres may choose to use rapid transfer beds, rapid triage services within cardiac catheterization units themselves or other bed management strategies. Noninvasive centres are also required to assist in the overall functioning of the tertiary care cardiac catheterization and revascularization referral system by appropriately assessing risk of patients presenting with ACS. Trials assessing the role of routine early invasive management of patients with ACS have excluded patients with major comorbidities. Therefore, referring hospitals must take primary responsibility for the assessment of realistic benefits of invasive therapies in patients, for instance, who are frail, or who have other major debilitating illnesses or other competing causes for death (dialysis dependency, metastatic malignancy or dementing illness). Referring centres must provide pertinent information with respect to comorbidities and factors that affect safe completion of cardiac catheterization (eg, presence of significant peripheral vascular disease or previous CABG). To ensure optimal flow of patients to the tertiary cardiac centre, referring hospitals must make every effort to repatriate their patients as quickly as possible from the invasive centre. It would not be unreasonable to establish a repatriation standard to home hospitals of 24 h to 48 h to facilitate the cardiac triage system. In short, each province and region must develop a comprehensive system for rapid diagnosis, risk stratification and triage of patients with NSTEMACS.

A summary of risk categories and target times for revascularization is given in Table 5. High-risk patients with ACS should undergo urgent cardiac catheterization as soon as possible and certainly within 24 h to 48 h of recognition of their clinical situation. These patients will be identified as having a TIMI risk score of 5 to 7 or clinical features, such as persistent or recurrent chest pain with electrocardiographic changes, heart failure, hypotension, arrhythmias, or a moderate or high troponin rise. If these patients cannot reach the cardiac catheterization laboratory within 4 h, they would benefit from a small peptide glycoprotein IIb/IIIa inhibitor, such as tirofiban or eptifibatid. Usually, PCI should take place at the same sitting as an ad hoc procedure with the goal of complete revascularization. Patients requiring CABG should be scheduled within three to five days.

Intermediate-risk patients with a calculated TIMI risk score of 3 to 4 or recognized as having non-ST elevation MI with a

**TABLE 5**  
**Canadian Cardiovascular Society Access to Care Working Group's triage categories and suggested targets for completing revascularization**

	Access to cardiac cath and PCI target	CABG target
High risk	24 h to 48 h	3 to 5 days
TIMI risk score of 5 to 7 Persistent or recurrent chest pain Dynamic ECG changes with chest pain CHF, hypotension, arrhythmias with chest pain Moderate or high (>5 ng/mL) troponin rise Age >75 years*		
Intermediate risk	3 to 5 days	2 to 3 weeks
TIMI risk score of 3 to 4 NSTEMI with small troponin rise (>1 to <5 ng/mL) Worst ECG T-wave inversion or flattening Significant LV dysfunction (EF <40%) Previous documented CAD, MI, CABG or PCI		
Low risk†	5 to 7 days	6 to 8 weeks
TIMI risk score of 1 to 2 Age <65 years No or minimum troponin rise (<1.0 ng/L) No further chest pain Inducible ischemia ≥7 METs workload		

\*Assumes no major comorbidity that would compete for mortality (eg, advanced malignancy, end-stage renal failure, advanced irreversible heart failure, frailty). †Low-risk patients should undergo further risk assessment by using noninvasive testing and only those with evidence of inducible ischemia should be revascularized. Revascularization for symptom burden also indicated based on existing standards for stable coronary artery disease (CAD). CABG Coronary artery bypass graft; cath Catheterization; CHF Congestive heart failure; ECG Electrocardiograph; EF Ejection fraction; LV Left ventricular; METs Metabolic equivalents; MI Myocardial infarction; NSTEMI Non-ST-segment elevation myocardial infarction; PCI Percutaneous coronary intervention; TIMI Thrombolysis in Myocardial Infarction

small troponin rise, no hemodynamic compromise, no or mild electrocardiographic changes (T-wave inversion), evidence of significant LV dysfunction, previous documented coronary artery disease, or previous MI or CABG operation should undergo cardiac catheterization within three to five days. They should also normally undergo an ad hoc PCI at the time of their diagnostic procedure. Patients who require CABG surgery should have their operation scheduled within two to three weeks.

Low-risk ACS patients may be recognized by a low TIMI risk score (1 to 2) or clinically as younger patients (younger than 65 years) with no or only modest troponin increases and no further chest discomfort. Unless there are recurrent unstable symptoms, these patients can still be managed with a 'watchful waiting' strategy and undergo noninvasive assessment. Those with positive noninvasive studies or inducible angina should undergo angiography within five to seven days. PCI can take

## REFERENCES

- Naylor CD, Sykora K, Jaglal SB, Jefferson S. Waiting for coronary artery bypass surgery: Population-based study of 8517 consecutive patients in Ontario, Canada. *Lancet* 1995;346:1605-9.
- Black N, Langham S, Petticrew M. Coronary revascularization: Why do rates vary geographically in the UK? *J Epidemiol Community Health* 1995;49:408-12.
- Bowling A, Bond M, McKee D, et al. Equity in access to exercise tolerance testing, coronary angiography, coronary artery bypass grafting by age, sex and clinical indications. *Heart* 2001;85:680-6.
- Wennberg D, Dickens J Jr, Soule D, et al. The relationship between the supply of cardiac catheterization laboratories, cardiologists and the use of invasive cardiac procedures in northern New England. *J Health Serv Res Policy* 1997;2:75-80.
- Gregory PM, Malka ES, Kostis JB, Wilson AC, Akora JK, Rhoads GG. Impact of geographic proximity to coronary revascularization services on service utilization. *Med Care* 2000;38:45-57.
- Bhatt DL, Roe MT, Peterson ED, et al; CRUSADE Investigators. Utilization of early invasive management strategies for high-risk

place at the same sitting or can be scheduled electively for six to eight weeks, as should CABG, if indicated. If inducible ischemia occurs at a low level (less than 4 metabolic equivalents), or with hypotension or evidence of LV dilation with exercise, the patient should be upgraded to at least an intermediate risk.

## OLDER PATIENTS

Besides geographical proximity, age is the other major reason for not being referred for cardiac catheterization (41-43). Subgroup analysis from TACTICS-TIMI 18, which excluded patients with significant comorbid illnesses, indicated a gradient of benefit, with the most elderly benefiting the most from an early invasive strategy (43). For instance, with the cohort younger than 65 years, the number needed to treat at six months was 250 compared with only nine in those enrolled who were older than 75 years of age. Under the age of 65 years, only four deaths or MIs were prevented per 1000 patients treated compared with 48 per 1000 treated in the 65 to 75 age group, and 108 deaths or MIs prevented in those older than 75 years. Thus, age alone should not be a contraindication to an early invasive strategy, although patients with significant comorbidities that will limit their life may not benefit from routine early invasive management strategies.

## CONCLUSIONS

NSTEACS require a rapid triage system, and the public system must ensure that satisfactory resources are in place to allow the urgent transfer of these patients for rapid diagnosis and management. All stakeholders involved in the care of these patients – payer, administrators, referring physicians and tertiary care physicians – must affirm the appropriateness of these standards and work continuously to achieve them. Interventionalists need to make themselves available for consultation and continuing health education to primary care practitioners and generalists to emphasize appropriate indications for referral of patients with NSTEACS. A transparent access report card needs to be developed and reported publicly. It should include not only the ability to meet access standards but also measures of referral rates from referring institutions or districts to ensure equitable access from these noninvasive centres. These referring institutions should also have repatriation standards for the return of patients once their invasive therapies are completed.

The Access to Care Working Group believes that the process of care and standards outlined above are a reasonable extrapolation of the literature. There remain unanswered questions, particularly around what are the best clinical risk markers to delineate the triage categories of high risk, intermediate risk and low risk. In addition, how useful are clinical risk scores in assisting clinicians in triaging patients for invasive therapies? Nevertheless, we feel that these are reasonable standards to assure that most Canadians, regardless of where they present, will receive the most appropriate care within the most appropriate time frame.

- patients with non-ST-segment elevation acute coronary syndromes: Results from the CRUSADE Quality Improvement Initiative. *JAMA* 2004;292:2096-104.
7. Pilote L, Miller DP, Califf RM, Rao JS, Weaver WD, Topol EJ. Determinants of the use of coronary angiography and revascularization after thrombolysis for acute myocardial infarction. *N Engl J Med* 1996;335:1198-205.
  8. Ben-Shlomo Y, Chaturvedi N. Assessing equity in access to health care provision in the UK: Does where you live affect your chances of getting a coronary artery bypass graft? *J Epidemiol Community Health* 1995;49:200-4.
  9. Hippisley-Cox J. Inequities in access to coronary angiography and revascularization: The association of deprivation and location of primary care services. *Br J Gen Pract* 2000;50:449-54.
  10. Langham S, Basnett I, McCartney P, et al. Addressing the inverse care law in cardiac services. *J Public Health Med* 2003;3:202-7.
  11. Alter DA, Tu JV, Austin PC, Naylor CD. Waiting times, revascularization modality, and outcomes after acute myocardial infarction at hospitals with and without on-site revascularization facilities in Canada. *J Am Coll Cardiol* 2003;42:410-9.
  12. Juul-Moller S, Edvardsson N, Jahnmatz B, Rosen A, Sorensen S, Ombus R. Double-blind trial of aspirin in primary prevention of myocardial infarction in patients with stable chronic angina pectoris. The Swedish Angina Pectoris Aspirin Trial (SAPAT) Group. *Lancet* 1992;340:1421-5.
  13. FRAGmin and Fast Revascularization during In Stability in Coronary artery disease Investigators. Long-term low-molecular-mass heparin in unstable coronary-artery disease: FRISC II prospective randomised multicentre study. *Lancet* 1999;354:701-7. (Erratum in 1999;354:1478)
  14. The PURSUIT Trial Investigators. Inhibition of platelet glycoprotein IIb/IIIa with eptifibatid in patients with acute coronary syndromes. *N Engl J Med* 1998;339:436-43.
  15. Anand SS, Yusuf S, Pogue J, Weitz JI, Flather M. Long-term oral anticoagulant therapy in patients with unstable angina or suspected non-Q-wave myocardial infarction: Organization to assess strategies for ischemic syndromes (OASIS) pilot study results. *Circulation* 1998;98:1064-70.
  16. Bengtson A, Karlsson T, Hjalmarson A, Herlitz J. Complications prior to revascularization among patients waiting for coronary artery bypass grafting and percutaneous transluminal coronary angioplasty. *Eur Heart J* 1996;17:1846-51.
  17. Henpiny Yue Cesena F, Favarato D, Machado Cesar LA, de Oliveira SA, da Luz PL. Cardiac complications during waiting for elective coronary artery bypass graft surgery: Incidence, temporal distribution predictive factors. *Eur J Cardiothorac Surg* 2004;25:192-202.
  18. Chester M, Chen L, Kaski JC. Identification of patients at high risk for adverse coronary events while awaiting routine coronary angioplasty. *Br Heart J* 1995;73:216-22.
  19. Doogue M, Brett C, Elliot JM. Life and death on the waiting list for coronary bypass surgery. *N Z Med J* 1996;110:26-30.
  20. Jackson NW, Doogue MP, Elliot JM. Priority points and cardiac events while waiting for coronary bypass surgery. *Heart* 1999;81:367-73.
  21. Koch KT, Piek JJ, David GK, Mulder K, Peters RJG, Lie KI. Does a waiting time for elective coronary angioplasty affect the primary success rate? *Heart* 1997;77:432-6.
  22. Koonen EM, Hutten BA, Kelder JC, Redekop WK, Tijssen AGP, Kingma JH. Morbidity and mortality waiting for coronary bypass surgery. *Eur J Cardiothorac Surg* 2001;19:260-5.
  23. Plomp J, Redekop WK, Dekker FW, et al. Death on the waiting list in the Netherlands in 1994 and 1995. *Heart* 1999;81:593-7.
  24. Rexius H, Brandrup-Wognsen G, Oden A, Jeppsson A. Mortality on the waiting list for coronary artery bypass grafting: Incidence and risk factors. *Ann Thorac Surg* 2004;77:769-75.
  25. Beanlands RSB, Hendry PJ, Masters RG, deKemp RA, Woodend K, Ruddy TD. Delay in revascularization is associated with increased mortality rate in patients with severe left ventricular dysfunction and viable myocardium on fluorine 18-fluorodeoxyglucose positron emission tomography imaging. *Circulation* 1998;98:II53-6.
  26. Bax JJ, Schinkel AFL, Boersma E, et al. Early versus delayed revascularization in patients with ischemic cardiomyopathy and substantial viability: Impact on outcome. *Circulation* 2003;108(Suppl II):II39-42.
  27. Haim M, Battler A, Behar S, et al. Acute coronary syndromes complicated by symptomatic and asymptomatic heart failure: Does current treatment comply with guidelines? *Am Heart J* 2004;147:859-64.
  28. The TIMI IIIB Investigators. Effects of tissue plasminogen activator and a comparison of early invasive and conservative strategies in unstable angina and non-Q-wave myocardial infarction. Results of the TIMI IIIB Trial. *Circulation* 1994;89:1545-56.
  29. Boden WE, O'Rourke RA, Crawford MH, et al. Outcomes in patients with acute non-Q-wave myocardial infarction randomly assigned to an invasive as compared with a conservative management strategy. *N Engl J Med* 1998;338:1785-92.
  30. Neumann FJ, Kastrati A, Pogatsa-Murray G, et al. Evaluation of prolonged antithrombotic pretreatment ("cooling-off" strategy) before intervention in patients with unstable coronary syndromes: A randomized controlled trial. *JAMA* 2003;290:1593-9.
  31. Spacek R, Widimsky P, Straka Z, et al. Value of first day angiography/angioplasty in evolving non-ST-segment elevation myocardial infarction: An open multicenter randomized trial. The VINO Study. *Eur Heart J* 2002;23:230-8.
  32. The FRISC II Investigators. Invasive compared with non-invasive treatment in unstable coronary artery disease: FRISC II perspective randomized multi centre study. *Lancet* 1999;354:708-15.
  33. Cannon CP, Weintraub WS, Demopoulos LA, et al. TACTICS (Treat Angina with Aggrastat and Determine Cost of Therapy with an Invasive or Conservative Strategy)-Thrombolysis in Myocardial Infarction 18 Investigators. Comparison of Early Invasive and Conservative Strategies in Patients with Unstable Coronary Syndromes Treated with Glycoprotein II-B III-A Inhibitor Tirofiban. *N Engl J Med* 2001;344:1879-87.
  34. Fox KA, Poole-Wilson PA, Henderson RA, et al; Randomized Intervention Trial of unstable Angina Investigators. Interventional versus conservative treatment for patients with unstable angina or non-ST-elevation myocardial infarction: The British Heart Foundation RITA 3 randomised trial. *Lancet* 2002;360:743-51.
  35. Sabatine MS, Antman EM. The thrombolysis in myocardial infarction risk score in unstable angina/non-ST-segment elevation myocardial infarction. *J Am Coll Cardiol* 2003;41(4 Suppl S):89S-95S.
  36. Boden WE. "Routine invasive" versus "selective invasive" approaches to non-ST-segment elevation acute coronary syndromes management in the post-stent/platelet inhibition era. *J Am Coll Cardiol* 2003;41(4 Suppl S):113S-22S.
  37. Bertrand ME, Simoons ML, Fox KAA, et al; for The Task Force on the Management of Acute Coronary Syndromes of the European Society of Cardiology. Management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *Eur Heart J* 2002;23:1809-40.
  38. Boersma E, Pieper KS, Steyerberg EW, et al. Predictors of outcome in patients with acute coronary syndromes without persistent ST-segment elevation. Results from an international trial of 9461 patients. The PURSUIT Investigators. *Circulation* 2000;101:2557-67.
  39. Eagle KA, Lim MJ, Dabbous OH, et al; GRACE Investigators. A validated prediction model for all forms of acute coronary syndrome: Estimating the risk of 6-month postdischarge death in an international registry. *JAMA* 2004;291:2727-33.
  40. Morrow DA. New insight into clinical risk scores for patients with acute coronary syndromes. *Am Heart J* 2004;146:754-6.
  41. Giugliano RP, Camargo CA, Lloyd-Jones DM, et al. Elderly patients receive less aggressive medical and invasive management of unstable angina: Potential impact of practice guidelines. *Arch Intern Med* 1998;158:1113-20.
  42. Barakat K, Kennon S, Wilkinson P, Ranjadayalan K, Timmis AD. Selection bias in management of unstable angina. *J R Coll Physicians Lond* 2000;34:179-84.
  43. Bach RG, Cannon CP, Weintraub WS, et al. The effect of routine, early invasive management on acute outcome for elderly patients with non-ST-segment elevation acute coronary syndromes. *Ann Intern Med* 2004;141:186-95.