CARDIAC CARE NETWORK

MANAGEMENT OF ACUTE CORONARY SYNDROMES

BEST PRACTICE RECOMMENDATIONS FOR REMOTE COMMUNITIES

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Foreword

The Cardiac Care Network of Ontario (CCN) is a system support to the Ministry of Health and Long-Term Care, Local Health Integration Networks, hospitals, and care providers dedicated to improving quality, efficiency, access and equity in the delivery of the continuum of cardiac services in Ontario. Our priority is to ensure the highest quality of cardiovascular care, based on established standards and guidelines, and we actively monitor access, volumes and outcomes of advanced cardiac procedures in Ontario. In addition, CCN works collaboratively with provincial and national organizations to share ideas and resources to co-develop strategies that enhance and support the continuum of cardiovascular care, including prevention, rehabilitation, and end-of-life care.

The Cardiac Care Network works with hospitals in Ontario to provide cardiac services across the province. In addition to helping plan, coordinate, implement, and evaluate cardiovascular care in Ontario, CCN is responsible for the provincial cardiac registry in Ontario. The information collected in the cardiac registry includes wait time information as well as specific clinical parameters required to evaluate key components of care and determine risk-adjusted outcomes. Through scientific evidence, expert panels and working groups, CCN uses consensus-driven methods to identify best practice and strategies to effectively delivery cardiovascular services, across the continuum of care.

CCN is committed to improving the quality of cardiovascular care in Ontario. In support of Health Care Renewal in Canada's strategic priorities, CCN developed a best practice document for acute coronary syndrome to improve access and to standardize healthcare delivery for remote communities.

Executive Summary

Acute coronary syndromes (ACS) are the most prevalent cardiac diagnoses requiring emergency medical services and acute care hospitalization worldwide. The subgroups of ACS patients with acute myocardial infarction (AMI) are associated with the highest mortality and morbidity if not treated with appropriate reperfusion therapy in a timely matter. The treatment and management of an AMI has improved dramatically over the last decade; cardiac centres in Ontario are now operating 24/7 to provide access to emergency and urgent cardiac catheterization and Percutaneous Coronary Intervention (PCI) services to all Ontario residents. While PCI centres in Ontario are now operating around the clock to improve timely access to invasive cardiology procedures, it has been reported that remote areas with a high proportion of Aboriginal residents do not have the same access to invasive cardiology services as do areas with low Aboriginal populations (CIHI, 2013).

Through collaborative efforts between Health Canada and CCN, opportunities were identified to improve access to invasive cardiology procedures and AMI management in remote communities. This document outlines in detail best practice recommendations as they relate to Acute Coronary Syndrome (ACS) management which includes AMI subsets of ST Segment Myocardial Infarction (STEMI), Non ST Segment Myocardial Infarction (NSTEMI), as well as Unstable Angina (UA) diagnoses. CCN identified opportunities for standardization of minimum equipment requirements at nursing stations, ACS treatment protocols, transfer recommendations, and recommended post-procedural management. The document takes into consideration the unique structure of healthcare delivery in remote communities and tailors its recommendations accordingly.

Best practice recommendations for ACS management in nursing stations:

1. All RNs working at nursing stations are trained in ACLS, ECG interpretation, and ACS management to ensure best practices are applied;
2. All nursing stations have a visible acute coronary syndrome algorithm to ensure patients are managed according to best practices;
3. All nursing stations are equipped with the following minimum equipment:
    a. 12-Lead ECG;

   b. Cardiac monitors;
   c. Defibrillators.
4. CCN STEMI protocols developed to ensure timely and appropriate diagnosis and management of STEMI patients are adopted as the standard of practice in all nursing stations in Ontario, supported by Regional Base Hospitals, ORNGE, EMS, and PCI Centres as well as primary care physicians;
5. All nursing stations have fibrinolysis therapy readily available to be administered to all eligible STEMI patients within 30 minutes of their arrival to a nursing station;
6. All nursing stations are equipped with the following adjuvant therapies:
   a. Anticoagulant therapies;
   b. Antiplatelet therapies.
7. All nursing stations are equipped with point-of-care testing devices that allow the monitoring of CBC, troponin, INR and creatinine;
8. CCN NSTEMI/UA protocols developed to ensure timely and appropriate diagnosis and management of NSTEMI/UA patients are adopted as the standard of practice in all nursing stations in Ontario, supported by Regional Base Hospitals, ORNGE, EMS, and PCI Centres as well as primary care physicians;
9. All nursing stations adopt recommended performance measures and quality indicators for data collection and participation in a provincial QA program;
10. All nursing stations have a process in place to manage AMI patients post discharge if prescribed medications are not available for the patient immediately post discharge;
11. All nursing stations function as a primary point of contact to establish a linkage between cardiac rehabilitation services and the discharged patients;
12. All nursing stations review post discharge recommendations and act as a liaison between the primary health care provider and the patient.

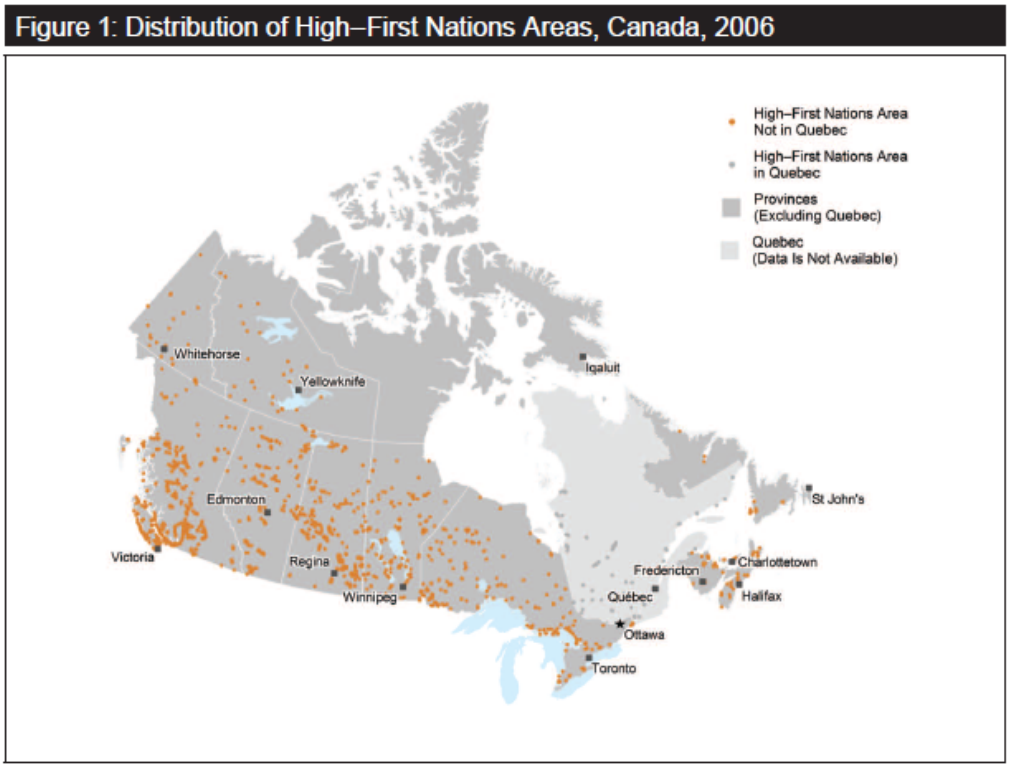
Background

Acute myocardial infarction is caused by acute plaque rupture and thrombus formation in the coronary artery resulting in a sudden disruption in blood flow to the heart muscle and death of heart tissue. AMI can be classified into ST-segment elevation myocardial infarction (STEMI) and non-STEMI (NSTEMI), which are distinguished based on the findings from a diagnostic electrocardiogram (ECG). Data from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD) suggest that the incidence of AMI in Ontario is approximately 193 of every 100,000 adult residents, which represents approximately 19,800 AMI patients per year in Ontario.

AMI has a mortality of 30% with half of deaths occurring before hospital arrival (Van de Werf et al., 2003). Recent data from Quebec has shown that providing STEMI care in hospitalized patients that is both appropriate and timely (according to guideline-based practice) reduces 30-day mortality rates by half. The reduction in mortality is true whether the chosen method of reperfusion is fibrinolysis or primary percutaneous coronary intervention (pPCI) (Lambert et al., 2010). STEMI care is often characterized by the phrase “time is muscle” highlighting the importance of timely reperfusion in order to save the heart tissue.

The ability to recognize the clinical presentation of AMI is critical to achieving timely reperfusion and the reduction of mortality and morbidity associated with misdiagnosed AMIs (Rollando, D., et. al. 2012). Remote communities are unique because their geography often requires exclusive use of air ambulance services, lack of on-site 24/7 physician coverage, and minimal equipment and resources to provide optimal patient care (Figure, 1; CIHI 2013). On-site healthcare personnel in remote communities are primarily Registered Nurses (RNs) who can page a physician on-call if needed. It is therefore essential that all RNs are trained in Advanced Cardiovascular Life Support (ACLS), are highly skilled in ECG acquisition and interpretation, and have the appropriate resources such as equipment, medications and best practice standardized STEMI and NSTEMI protocols to manage AMI patients in the absence of direct physician supervision.

Figure 1: Distribution of high-First Nations areas in Canada (CIHI, 2013).



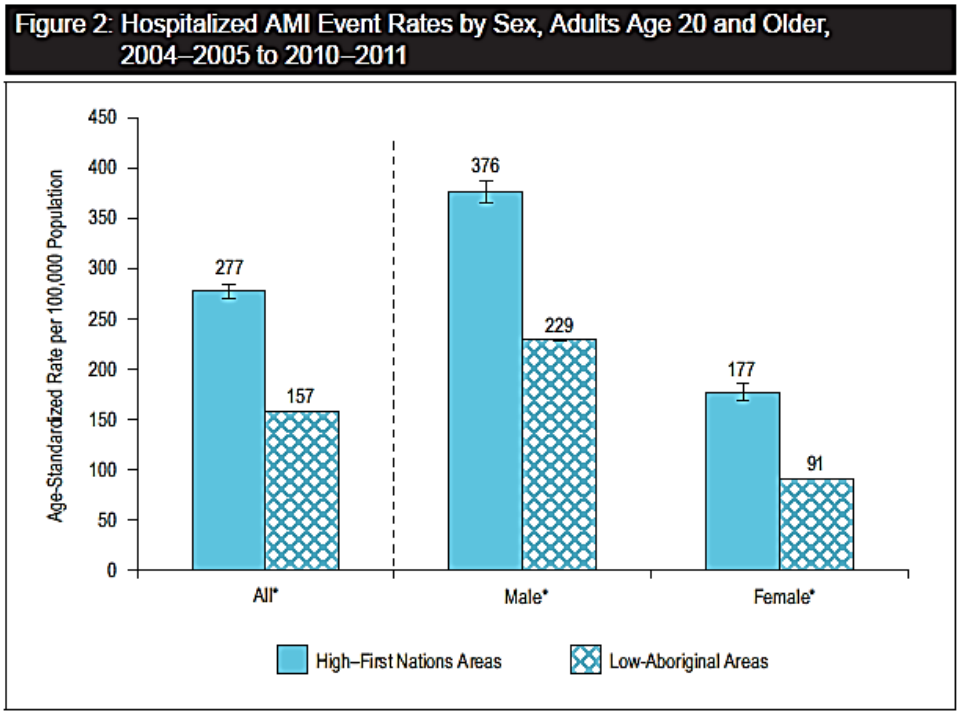
All STEMI patients in Ontario should have timely access to appropriate care, no matter where they live and/or where they present. Patients in remote communities require special consideration, as the initial treatment is most often delivered by an RN with the support of a physician on-call.

Current State Assessment

Remote communities in Northern Ontario and across Canada rely on nursing stations for pre-hospital triage and air ambulance for transport in the event of an emergency. Nurses are able to obtain vital signs and an ECG, and transmit this information to the physician on-call. Cardiac monitors, intravenous pumps, and automated external defibrillators (AEDs) are not available at all nursing stations, and nurses are not always trained in ACLS or in the use of AEDs.

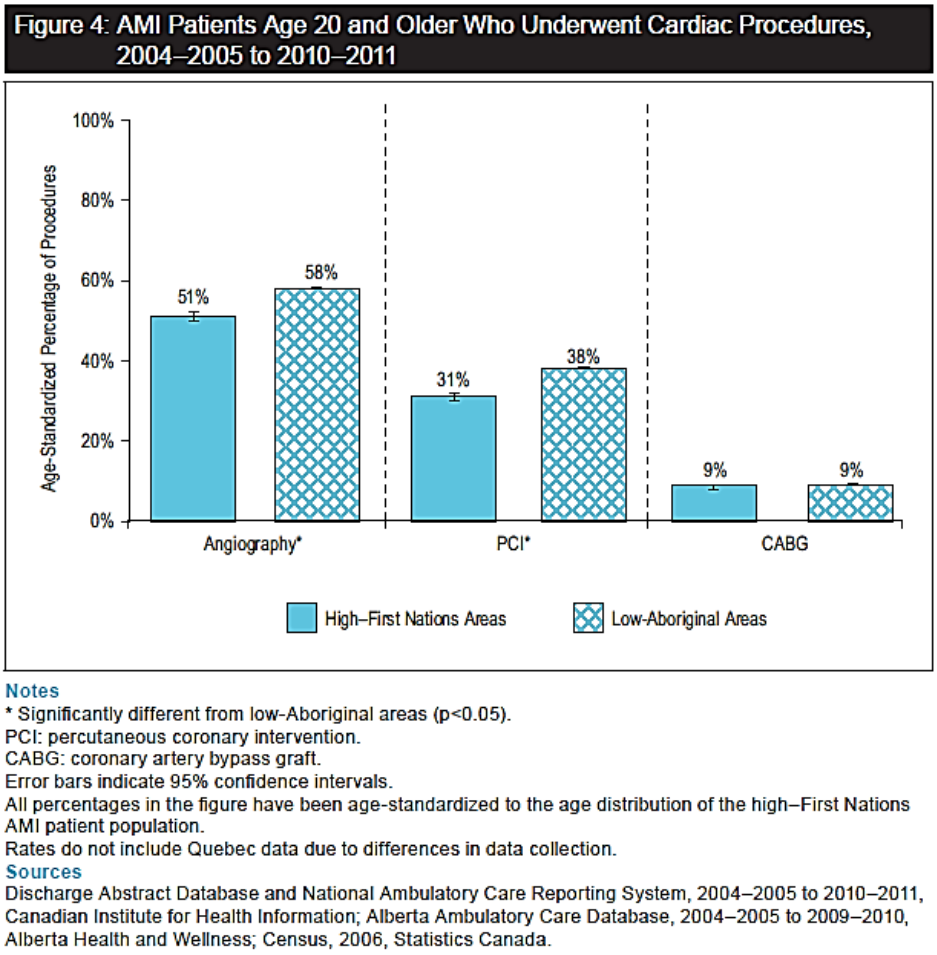
Remote communities have a greater population of First Nations people. These communities have been shown to have much higher rates of hospitalizations for AMI, compared with areas with low- numbers of Aboriginal inhabitants (Figure 2; CIHI, 2013). In addition, AMI patients from high-First Nations areas were much younger than AMI patients from the low-Aboriginal areas (mean age of 64 versus 71). It has also been suggested that AMI patients from high-First Nation communities are less likely to receive advanced cardiac care including coronary angiography, percutaneous coronary intervention, or bypass surgery (Figure 3; CIHI, 2013). While the exact reasons are not clear, multiple factors have been identified that may be attributable, including late presentation after onset of symptoms, lack of standardized STEMI management protocols, no direct link to a tertiary care centre or involvement in an AMI network of care, and delays in air ambulance transfers.

Figure 2: Age standardized rates of hospitalization for AMI, by gender, for low- Aboriginal and high-First Nations areas of Canada (CIHI, 2013).



Notes
* Significantly different from low-Aboriginal areas ($p<0.05$).
Error bars indicate 95% confidence intervals.
Rates have been age-standardized to the population that identified as First Nations in the 2006 Census.
Rates do not include Quebec data due to differences in data collection.
Sources
Discharge Abstract Database, 2004–2005 to 2010–2011, Canadian Institute for Health Information; Census, 2006, Statistics Canada.

Figure 3: Use of advanced cardiac services in servicing AMI patients from high- First Nations and low-Aboriginal areas (CIHI, 2013).



Guidelines for the Identification of Patients with Acute Coronary Syndrome

In suspected cases of ACS, rapid assessment and triage is critical for effective therapy to be initiated. Early recognition of signs and symptoms and taking the right steps to identify, distinguish, and manage ACS subtypes (STEMI and NSTEMI/UA) will improve patient outcomes (Bradley et al., 2006). Recognizing the signs and symptoms, such as chest pain or shortness of breath suggestive of an ACS, and obtaining an ECG as soon as possible (goal of less than 10 minutes following presentation of a patient) should be the standard of practice to manage this patient population. It is essential that all nursing staff working in remote communities are trained in the recognition and management of ACS.

Best Practice Recommendation 1: All RNs working at nursing stations are trained in ACLS, ECG interpretation and ACS management to ensure best practices are applied.

It is also recommended that all nursing stations have a visible chest pain algorithm to ensure that all patients are managed according to standard protocols; this approach is associated with improved reperfusion and better clinical outcomes for patients.

Best Practice Recommendation 2: All nursing stations have a visible acute coronary syndrome algorithm to ensure patients are managed according to best practices.

ACS patient management - triage and first assessment guidelines (Wright et. al. 2011)

Patient Triage

Patients with the following chief complaints require immediate assessment by the triage nurse and should be referred for further evaluation:

- Chest pain, pressure, tightness, or heaviness; pain in neck, jaw, shoulders, back, or one or both arms;
- Indigestion or “heartburn”, nausea and/or vomiting associated with chest discomfort;
- Persistent shortness of breath;

- Weakness, dizziness, lightheadedness, loss of consciousness;

Registered Nurse Responsibilities for Patient Assessment

Patients with the following symptoms and signs require immediate assessment for the initiation of the ACS protocol:

- Chest pain or severe epigastric pain, non-traumatic in origin, with components typical of myocardial ischemia or AMI:
    - Central/substernal compression or crushing chest pain;
    - Pressure, tightness, heaviness, cramping, burning, aching sensation;
    - Unexplained indigestion, belching, epigastric pain;
    - Pain in neck, jaw, shoulders, back, or 1 or both arms;
- Associated dyspnea;
- Associated nausea and/or vomiting;
- Associated diaphoresis;

If these symptoms are present, obtain vital signs and a stat ECG and transmit immediately to physician on-call.

Patient Medical History and Vital Signs

The triage nurse should take a brief, targeted, initial history with an assessment of current or past history of:

- Coronary artery bypass graft (CABG), PCI, Coronary Artery Disease (CAD), angina on effort, or MI;
- Nitroglycerin use to relieve chest discomfort;
- Risk factors, including smoking, hyperlipidemia, hypertension, diabetes mellitus, family history of CAD, and cocaine or methamphetamine use;
- Arrhythmia history should include utilization of permanent pacemaker or implantable cardioverter-defibrillator;
- Regular and recent medication use.

Special Considerations

- Women may present more frequently than men with atypical chest pain and symptoms such as epigastric pain and unexplained indigestion.
- Patients with diabetes may have atypical presentations due to autonomic dysfunction.
- Elderly patients may have atypical symptoms such as generalized weakness, stroke, syncope, or a change in mental status.

Immediate General Treatments and Interventions

The treatment of a patient with chest pain should focus on a rapid assessment, stabilization, diagnosis and if needed reperfusion therapy. Upon arrival to the nursing station, the patient should be connected to continuous cardiac monitoring. Initial physical assessment and a 12-lead ECG should be done within 10 minutes of patient's arrival to the nursing station. Upon acquisition, all ECGs must be transmitted to the physician on-call for immediate interpretation.

Best Practice Recommendation 3: All nursing stations are equipped with the following minimum equipment:

1. **12-Lead ECG;**
2. **Cardiac monitors;**
3. **Defibrillators.**

Table 1: In addition to reperfusion therapy, all ACS patients without contraindications should receive adjunctive treatments (O'Gara, et al. 2013).

Treatment	Indications	Avoid/Caution
Oxygen	• Clinically significant hypoxemia (oxygen saturation < 90%) • Heart failure • Dyspnea	• Caution with chronic obstructive pulmonary disease and CO2 retention
Nitroglycerin	• Ongoing chest pain • Hypertension and HF	• Avoid in suspected right ventricular infarction • Avoid with SBP < 90 mm Hg or if SBP 30 mm Hg below baseline • Avoid if recent (24 to 48 h) use of phosphodiesterase type 5 inhibitors.
Morphine	• Pain • Anxiety • Pulmonary edema	• Suspected right ventricular infarction • Lethargic or moribund patient • Hypotension • Bradycardia • Known hypersensitivity
Beta-Receptor Antagonists	• Oral: All patients without contraindication • IV: Patients with refractory hypertension or ongoing ischemia without contraindication	• Signs of heart failure • Low output state • Increased risk of cardiogenic shock • Hypotension • Bradycardia • Prolonged first-degree or high-grade AV block • Reactive airways disease

*Note: the table does not list all contraindications and precautions.

STEMI

Critical to the successful management of STEMI patients is the development of regional systems of STEMI care. The 2013 ACC/AHA STEMI guidelines indicate "All communities should create and maintain a regional system of STEMI care that includes assessment and continuous quality improvement of EMS and hospital-based activities" (O'Gara et al., 2013). The foundation of care for STEMI is the rapid restoration of blood flow in the coronary artery. There are two initial treatment options or "reperfusion" modalities:

- **Primary PCI** - defined as the mode of reperfusion when the STEMI patient is taken directly to the cardiac catheterization (cath) lab to undergo PCI on an emergency basis. PCI is a procedure in which the coronary arteries are mechanically reopened using a balloon and the placement of a stent in the blocked arteries. Primary PCI is used as a first line therapy for STEMI patients when access to a PCI lab is available within specific time parameters.
- **Fibrinolysis therapy** (i.e., clot-busting drugs). Administration of fibrinolysis therapy should be done within 30 minutes of presentation to an emergency department (ED). Fibrinolysis is typically initiated by a physician in an ED when pPCI cannot be performed within 120 minutes of patient arrival. After fibrinolysis, there are three options for ongoing patient management:
    1. **Rescue PCI** - The decision to perform a rescue PCI is generally made if the patient has ongoing chest pain or ECG changes of STEMI at 60 to 90 minutes following fibrinolysis or if the patient has recurrent chest discomfort, the patient may be transferred to a PCI Centre for treatment;
    2. **Pharmacoinvasive PCI** - is a strategy in which the patient is given fibrinolysis therapy and is transferred to a PCI Centre for an intervention within 24 hours. The patient is transferred regardless of the response to fibrinolysis;
    3. **Other PCI** - If the patient is low risk and is otherwise clinically stable after successful reperfusion with fibrinolysis, the patient may be admitted to the local critical care unit and scheduled for coronary angiography +/- PCI during hospital admission.

There is an urgent need to standardize protocols for STEMI patients in regions where the nursing station is typically the first point of contact. Currently, the RN assesses the patient, pages the physician on-call,

and transmits the ECG to the physician, who then contacts the emergency department or intensive care unit physician at the nearest PCI hospital to determine whether a bed is available and to arrange transfer. Air ambulance services take approximately three to four hours, and sometimes as long as 48 hours depending on the weather. STEMI patients are typically treated with conservative measures while awaiting transport to an acute care centre capable of a PCI. It has been identified that there is a lack of standardization in care and transportation protocols across nursing stations in remote areas. Nursing stations are physically isolated and often do not have formal relationships established with more advanced cardiac centres. It is well established that STEMI care is best facilitated by a system of care that involves a network of providers, therefore nursing stations should have immediate access to advanced cardiac centres to ensure all patients receive timely access to appropriate care. The network is established with a high level of collaboration between an advanced cardiac centre and an acute care/triage facility, where best practices of STEMI management and transfer protocols are adopted.

Best Practice Recommendation 4: CCN STEMI protocols developed to ensure timely and appropriate diagnosis and management of STEMI patients are adopted as the standard of practice in all nursing stations in Ontario, supported by Regional Base Hospitals, ORNGE, EMS, and PCI Centres as well as primary care physicians.

While pPCI is recommended for STEMI when it can be performed rapidly (door to balloon < 120 minutes), the geographical disposition of the nursing stations and challenges with transportation may not permit the delivery pPCI within the recommended timelines. Therefore, it is recommended that all patients presenting to a nursing station should receive fibrinolysis within 30 minutes of their arrival, unless patients have contraindications to fibrinolysis (O'Gara, P. et. al. 2013).

Best Practice Recommendation 5: All nursing stations have fibrinolysis therapy readily available to be administered to all eligible STEMI patients within 30 minutes of their arrival to a nursing station.

STEMI Diagnosis

As outlined in previous ACS guidelines section, a patient presenting to a nursing station with symptoms suggestive of an acute MI should be evaluated and have an ECG done within 10 minutes.

STEMI patients require restoration of blood flow due to a complete occlusion of the coronary artery. To diagnose a STEMI the following conditions must be in place:

1. Patient presentation suggestive of ACS;
2. Diagnostic STEMI ECG defined as:
    a. ≥2 mm of ST segment elevation in 2 contiguous precordial leads in men (1.5 mm for women);
    b. ≥1mm in other leads (2 contiguous).

STEMI Management

Once STEMI diagnosis is established, the next step is to determine reperfusion possibilities.

Fibrinolysis Therapy Eligibility

In remote areas, the delivery of pPCI in a timely manner (i.e. meeting current guidelines) is nearly impossible; therefore healthcare providers will need to assess the patient for fibrinolysis therapy. Although it improves patient outcomes, administration of fibrinolysis therapy can place patients at increased risk for bleeding. Certain conditions are considered absolute contraindications to fibrinolysis therapy whereas others are considered relative contraindications. The relative and absolute contraindications must be evaluated prior to administration of fibrinolysis. Fibrinolysis therapy should not be given to individuals with absolute contraindications and/or patients with symptoms longer than 12 hours. For the relative contraindications the benefit must be weighed against the increased risk of bleeding in patients being considered for fibrinolysis therapy. Prior to drug administration the RN must insert two intravenous (IV) lines. It is preferred that the right wrist is not used for any IV line. It is essential that the patient is connected to a cardiac monitor at all times and that the defibrillator is ready to be used in case of emergency (O'Gara et al., 2013).

Contraindications and Cautions for Fibrinolysis Therapy in STEMI

Absolute Contraindications

- Any prior intra cranial hemorrhage
- Known structural cerebral vascular lesion (e.g., arteriovenous malformation)
- Known malignant intracranial neoplasm (primary or metastatic)
- Ischaemic stroke within 3 month EXCEPT acute ischaemic stroke within 4.5 h
- Suspected aortic dissection
- Active bleeding or bleeding diathesis (excluding menses)
- Significant closed-head or facial trauma within 3 months
- Intracranial or intra-spinal surgery within 2 months
- Severe uncontrolled hypertension (unresponsive to emergency therapy)
- For streptokinase, prior treatment with streptokinase within the previous 6 months

Relative Contraindications

- History of chronic, severe, or poorly controlled hypertension
- Significant hypertension on presentation (Systolic Blood Pressure > 180 mm Hg or Diastolic Blood Pressure > 110 mm Hg)
- History of prior ischaemic stroke > 3 months
- Dementia
- Known intracranial pathology not covered in absolute contraindications
- Traumatic or prolonged (> 10 min) cardiopulmonary resuscitation
- Major surgery (< 3 weeks)
- Recent (within 2 to 4 weeks) internal bleeding
- Non-compressible vascular punctures
- Pregnancy
- Active peptic ulcer
- Oral anticoagulant therapy

Administration of Fibrinolysis Therapy

At remote nursing stations, the administration of fibrinolysis may be performed by a nurse under direct physician supervision through Ontario Telemedicine Network (OTN) or indirect medical supervision through a telephone order. Each nursing station, as part of their regional STEMI program, will need to establish protocols with local physicians as well as in consultation with the nearest acute care hospital to decide what is best suited to meet their local circumstances. Patients managed with fibrinolysis therapy should receive adjuvant antiplatelet and anticoagulant therapy. Anticoagulants such as unfractionated heparin (UFH), low molecular weight heparin (e.g. Enoxaparin) and factor Xa inhibitors (e.g. Fondaparinux) inhibit thrombin and prevent clot formation. Currently, Enoxaparin, Heparin and Fondaparinux are approved for use in STEMI in Canada. All three are approved for use with fibrinolysis. Fondaparinux is not recommended for patients being transferred for pPCI. Enoxaparin requires dose adjustment for patients at least 75 years of age and for patients with renal insufficiency (creatinine clearance less than 30 ml per minute) when given with fibrinolysis therapy. Administration of antiplatelet therapy following fibrinolysis has been shown to improve vessel patency once the clot has been dissolved and prevent reinfarction. Aspirin (ASA) and Clopidogrel are approved in Canada to be given with fibrinolysis therapy.

Best Practice Recommendation 6: All nursing stations are equipped with the following adjuvant therapies:

- **Anticoagulant therapies;**
- **Antiplatelet therapies.**

Repeat ECG

It is important to repeat the ECG at 60 and 90 minutes post fibrinolysis therapy in order to determine if reperfusion has been successfully established. It is estimated that rescue PCI is required in 30 percent of patients treated with fibrinolysis (Woods, Sivarajan, Underhill, & Bridges, E. 2005).

Patient Management Post Fibrinolysis Administration

- Vital signs: repeat every 15 minutes x 4, THEN every 1 hour x 4 and as required
- Neurological assessment: hourly x 2, THEN every 4 hours and as required

- Cardiac monitoring from before initiation of any therapy until transfer to an acute care hospital
- Troponin I measurement every 8 hours until air ambulance arrives for transport

It is recommended that all nursing stations that manage STEMI populations have point-of-care testing devices to monitor, at minimum the most current troponin assay, complete blood count (CBC), international normalized ratio (INR) and creatinine.

Best Practice Recommendation 7: All nursing stations are equipped with a point-of-care testing device that allows the monitoring of troponin, CBC, INR and creatinine.

High Risk STEMI

If a patient has received fibrinolysis therapy and they are deemed to still be at high risk, it is recommended that the receiving PCI centre is informed of a high risk STEMI when the system is activated.

Features of a high risk STEMI include:

- ≥2mm ST-segment elevation in 2 anterior leads
- ≥1mm ST-segment elevation in 2 inferior leads coupled with 2mm ST-segment depression in anterior leads
- Killip Class II, III or IV
- Hypotension or tachycardia
- ECG evidence of right ventricular involvement (≥ 1 mm ST elevation in V4R)

NSTEMI/Unstable Angina

Patients presenting with symptoms and signs of cardiac ischaemia without persistent ST segment elevation on electrocardiogram have a working diagnosis of non-ST segment elevation ACS (NSTEACS). Further qualification as NST segment elevation MI (NSTEMI) or unstable angina (UA) will be defined by elevation of cardiac markers (i.e. troponin). While not typically as urgent as a STEMI with specific treatment targets, patients with UA/NSTEMI will need to be admitted to a hospital to determine ongoing management. Therefore, UA/NSTEMI patients will require ongoing care until they can be safely transferred to an acute care hospital. Following the triage and diagnosis of a UA/NSTEMI, risk

stratification is essential to determine the course of action for a given patient. High risk UA/NSTEMI patients are more prone to complications, can deteriorate quickly and require intensive monitoring. Management of high risk UA/NSTEMI patients may require the on-call physician to consult with the interventional cardiologist at the receiving centre. It is recommended that within the framework of AMI system of care, agreements and protocols shared between remote nursing stations and acute care hospitals should include strategies for management of high risk NSTEMI population (Table 2).

Table 2: Short term risk of death or nonfatal MI in patients with NSTEMI or unstable angina (from AHA/ACC clinical guidelines for management of NSTEMI-2011; (Wright et al., 2011)).

Feature	High Risk At least 1 of the following must be present:	Intermediate Risk No high-risk feature, but must have 1 of the following:	Low Risk No high- or intermediate-risk feature but may have any of the following features:
History	• Accelerating tempo of ischaemic symptoms in preceding 48 hr	• Prior MI, peripheral or cerebrovascular disease, or CABG; prior aspirin use	
Character of pain	• Prolonged ongoing (greater than 20 min) rest pain	• Prolonged (greater than 20 min) rest angina, now resolved, with moderate or high likelihood of CAD • Rest angina (greater than 20 min) or relieved with rest or sublingual NTG • Nocturnal angina • New-onset or progressive CCS class III or IV angina in the past 2 weeks without prolonged (greater than 20 min) rest pain but with intermediate or high likelihood of CAD (see Table 6)	• Increased angina frequency, severity, or duration • Angina provoked at a lower threshold • New onset angina with onset 2 weeks to 2 months prior to presentation
Clinical findings	• Pulmonary edema, most likely due to ischemia • New or worsening MR murmur third heart sound or new/worsening rates • Hypotension, bradycardia, tachycardia • Age greater than 75 years	• Age greater than 70 years	
ECG	• Angina at rest with transient ST-segment changes greater than 0.5 mm	• T-wave changes • Pathological Q waves or resting ST-depression less than 1 mm in multiple	• Normal or unchanged ECG

	• Bundle-branch block, new or presumed new • Sustained ventricular tachycardia	lead groups (anterior, inferior, lateral)	
Cardiac markers	• Elevated cardiac TnT, TnI, or CK-MB (e.g., TnT or TnI greater than 0.1 ng per ml)	• Slightly elevated cardiac TnT, TnI, or CK-MB (e.g., TnT greater than 0.01 but less than 0.1 ng per ml)	• Normal

*Estimation of the short-term risks of death and nonfatal cardiac ischaemic events in UA (or NSTEMI) is a complex multivariable problem that cannot be fully specified in a table such as this: therefore, this table is meant to offer general guidance and illustration rather than rigid algorithms. Adapted from AHCPR Clinical Practice Guidelines No. 10, Unstable Angina: Diagnosis and Management, May 1994 (124).

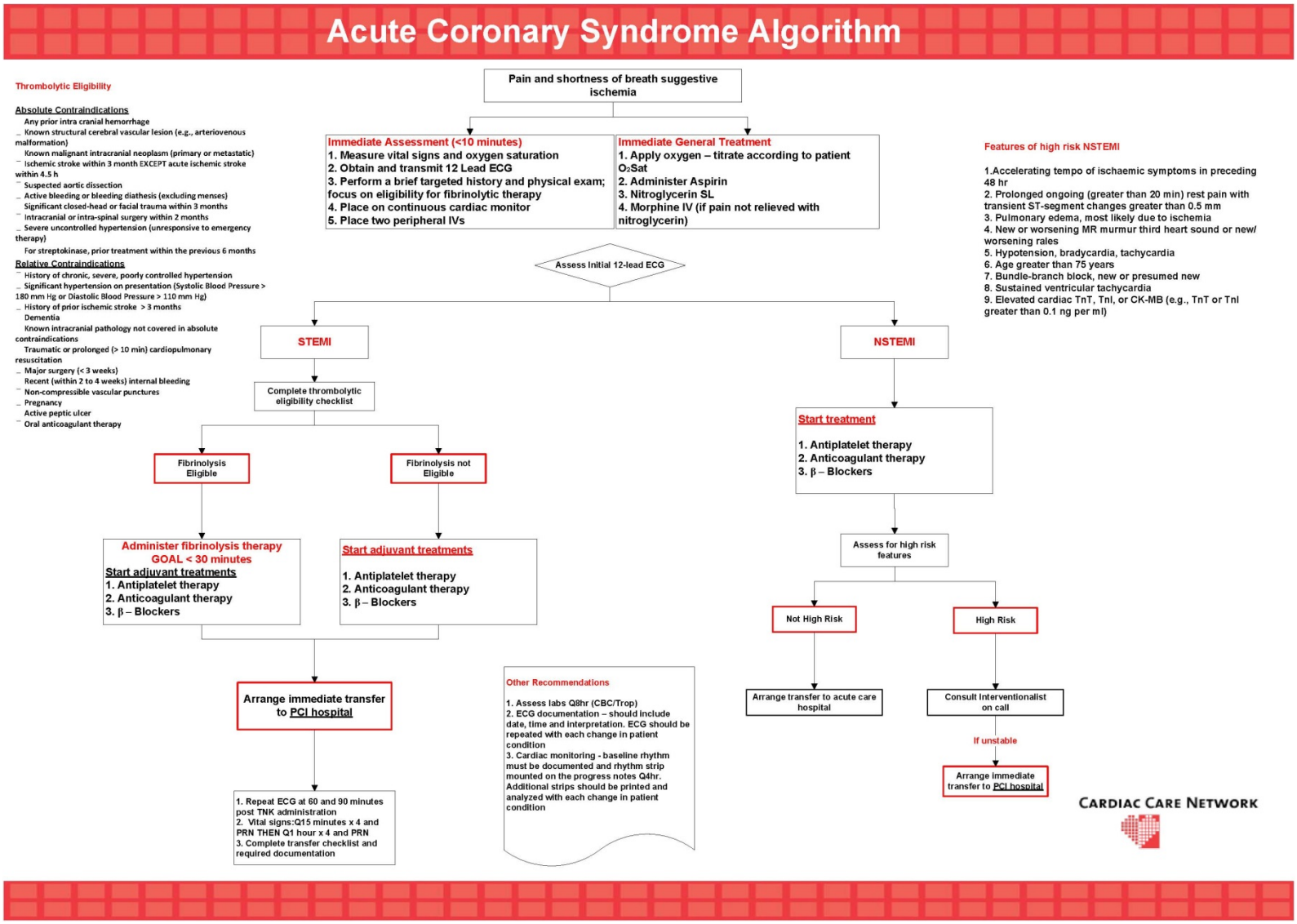
CABG = coronary artery bypass graft surgery; CAD = coronary artery disease; CCS = Canadian Cardiovascular Society; CK-MB = creatine kinase, MB fraction; ECG = electrocardiogram; MI = myocardial infarction; MR = mitral regurgitation; NTG = nitroglycerin; TnI = troponin I; TnT = troponin T; UA/NSTEMI = unstable angina/ non-ST-elevation myocardial infarction.

NSTEMI/UA Management

In patients where the ACS is determined to be NSTEMI, it is still imperative to monitor these patients closely and to transfer them to the nearest acute care hospital for ongoing management. NSTEMI patients should be administered anticoagulants (e.g. UFH, Enoxaparin or Fondaparinux) and Antiplatelet (e.g. ASA plus Clopidogrel or ASA plus Ticagrelor) therapy. It is important to assess the patient for features of high risk NSTEMI to determine if the most appropriate course of action is to transfer to the nearest PCI centre.

Best Practice Recommendation 8: CCN NSTEMI protocols developed to ensure timely and appropriate diagnosis and management of NSTEMI patients are adopted as the standard of practice in all nursing stations in Ontario, supported by Regional Base Hospitals, ORNGE, EMS, and PCI Centres as well as primary care physicians.

Figure 4: Acute Coronary Syndrome Algorithm



Quality Assurance (QA)

An ongoing QA plan is recommended by the ACC/AHA clinical guideline committee (O'Gara, P. et. al. 2013). While remote Ontario communities may not have the volume of AMI patients typically seen at some hospitals it is still critical to have a QA plan in place.

There are several patient level indicators that can be analyzed to improve processes. A mechanism for feedback among providers can be established to improve processes and patient outcomes. Table 3 summarizes the key time stamps and other quality indicators that should be captured on each patient who presents with symptoms of chest pain.

Table 3: Recommended Performance Measures and Quality Indicators

Quality Indicator	**Benchmark**
Chest pain onset time	
Arrival to nursing station time	
ECG acquisition	Ideally ECG acquisition will occur in less than 10 minutes from presentation
ECG transmission to physician	Immediately (post acquisition)
ECG interpretation by physician	Within 10 minutes
Fibrinolysis therapy administration	Door-to-needle times are recommended at ≤ 30 minutes from arrival to the nursing station
Air ambulance activation time	
Air ambulance arrival time	
Time of transfer (air ambulance departure time)	Transfer should occur as soon as possible once STEMI is diagnosed
STEMI reperfusion achieved	Yes/No
Administration of antiplatelet	Yes/No
Administration of anticoagulant	Yes/No

The Health Council of Canada published a progress report in 2013 on the health care renewal in Canada initiative and indicated that although initiatives were put in place to address inequalities in health status between Aboriginal and non-Aboriginal populations the affect it had on health status is unclear. It is recommended that remote nursing stations participate in provincial benchmarking and data collection.

In addition, each STEMI and NSTEMI case should be reviewed in detail to identify opportunities for improvement. Standardized data collection and reporting tools are essential for successful monitoring of AMI management (Appendix B). Participation in a provincial QA program will assist with benchmarking, quality improvement initiatives and evaluation of interventions put in place to improve AMI management in remote communities.

Best Practice Recommendation 9: All nursing stations adopt recommended performance measures and quality indicators for data collection and participation in a provincial QA program.

Post Discharge Follow-Up Guidelines

Medications and Secondary Prevention

All STEMI and high risk NSTEMI patients should be transferred immediately to the nearest PCI centre. Before returning to the community, patients and their families (caregivers) should be educated on the prescribed medications. These should include: dual antiplatelet therapy (ASA and Clopidogrel or ASA and Ticagrelor), beta blockers, Angiotensin Converting Enzyme (ACE) inhibitors (or Angiotensin Receptor Blockers (ARBs)), and statins. Some AMI patients will require oral anti-coagulation with warfarin, dabigatran or other oral anticoagulants for atrial fibrillation or Left Ventricle (LV) thrombus, and will require more focused education on management and closer follow-up.

Residents who are served by the nursing stations commonly receive their prescribed medications through the Non-Insured Health Benefits (NIHB). Medications are filled in by a pharmacy and flown in weather permitting. This process could take up to or more than a week in some cases. It is imperative that patients continue to receive their medical treatment post discharge uninterrupted with no waiting periods for medication shipments or any other delays.

Best Practice Recommendation 10: All nursing stations have a process in place to manage AMI patients post discharge if prescribed medications are not available for the patient immediately post discharge.

Cardiac Rehabilitation

Cardiac rehabilitation is recommended for all ACS patients. Therefore in addition to medications, an exercise prescription will be given so that patients can incorporate exercise as part of their rehabilitation regimen. The services delivered by a cardiac rehabilitation program go beyond exercise prescription. Cardiac rehabilitation consists of multidisciplinary teams comprised of some or all of: physicians, nurses, dieticians, psychiatrists, and pharmacists. The programs are designed to limit the physiological and psychological effects of cardiac illness, reduce the risk for sudden death or re-infarction, control of cardiac symptoms, stabilize or reverse the atherosclerotic process, and enhance the psychosocial and vocational status of selected patients. Cardiac rehabilitation is a comprehensive long-term program that involves medical evaluation, prescribed exercise, cardiac risk factor modification, education, and counseling (Balady, G., et. al.2011).

In remote areas, the use of technology, through groups like OTN, is a practical solution to provide cardiac rehabilitation services. The use of OTN has been implemented in parts of Ontario to improve access to stroke rehabilitation services. The similarities between cardiac and stroke rehabilitation suggest that OTN could easily be adapted to deliver cardiac rehabilitation services. It is recommended that each community establish access to cardiac rehabilitation services.

Best Practice Recommendation 11: All nursing stations function as a primary point of contact to establish a linkage between cardiac rehabilitation services and the discharged patients.

Follow-Up with Primary Health Care Provider

Following hospitalization, patients should be discharged with a clear plan that dictates cardiac rehabilitation, medications and interaction with primary care. When establishing a network for AMI care, discharge and transition planning should be included. In the absence of community support for AMI patients, transitions of care become a challenge. The community (healthcare providers, families and caregivers) require education on the modification of cardiovascular risk factors and disease management. Without these programs, AMI patients are more likely to have poorer outcomes once the acute phase has passed.

The Aboriginal communities have a high comorbid burden, with rates of diabetes being almost 1.5 fold higher than in non-Aboriginal communities. Given this alarming statistic, connecting with primary health care providers is essential in these communities. Management of comorbid conditions is essential to long-term prognosis in patients who have had AMI (Czarnecki, A. et. al. 2013).

Best Practice Recommendation 12: All nursing stations review post discharge recommendations and act as a liaison between the primary health care provider and the patient.

Future Direction

The purpose of this document is to support and facilitate the development and implementation of standardized protocols to manage ACS in remote communities. The document includes detailed recommendations on how to stabilize, manage and transfer ACS patients to PCI and non-PCI centres in Ontario. It is recognized that ACS management in nursing stations requires commitment and engagement of clinical champions in the province to improve the management and outcomes of AMI in the population that resides in remote communities. As part of the CCN efforts to support leading practices and quality improvement, this document outlines processes that support best practices in ACS care.

To support this initiative the STEMI working group recommends the following next steps:

- Develop strategies to raise local community education and awareness of signs and symptoms of ACS;
- Invest in infrastructure that supports safe management of STEMI and NSTEMI/UA patients;
- Develop AMI network of care where each nursing station is linked to a PCI centre;
- Implement STEMI and NSTEMI/UA protocols;
- Develop a quality assurance program that is linked to the provincial database for benchmarking and quality improvement purposes;

- Develop strategies to ensure that transitions from acute care settings to the community are in line to support best practices in AMI care (e.g. cardiac rehabilitation and follow up);
- Ongoing evaluation of the best practices implementation progress.

Best Practice Recommendation 12: All nursing stations review post discharge recommendations and act as a liaison between the primary health care provider and the patient.

Appendix A

Examples of Ontario Based STEMI Protocols

Thunder Bay Regional Health Science Centre

CODE STEMI FOR OUTLYING REGIONS

(WHERE ESTIMATED DOOR TO BALLOON TIME IS > 90 MIN)

Regional Health

healthy together

DIAGNOSIS FROM REGIONAL EMERGENCY DEPT.

Symptoms of chest, jaw, back or neck pain or pressure, SOB, sweating, dizziness, nausea consistent with myocardial ischemia

Direct admit to resuscitation room with **STAT** ECG and **IMMEDIATE** interpretation

12 LEAD ECG CRITERIA

- ≥1mm ST-segment elevation in 2 contiguous leads
- ≤12hrs since onset of symptoms

Give ASA 160 mg chewable

Give Nitro as required

Apply O2 as required

Start IV's x 2 (avoid Rt. wrist or hand)

Evaluate pt. for contraindications to fibrinolysis

TRANSFER AND ADMISSION

TO BE DONE CONCURRENTLY WITH LYTIC ADMINISTRATION DO NOT DELAY ADMINISTRATION OF LYTICS TO ARRANGE TRANSFER

- ER physician to call ORNGE(1-800-387-4672) for stat transport > 1HR (exception for Nipigon-option for land ambulance) (807-623-7342) to arrange for transfer to TBRHSC ICU in case of potential rescue PCI/or LYTIC contraindications
- ER physician to call Interventional Cardiologist on call (807) 684-6000
- Interventional Cardiologist to call ICU Intensivist and notify of patient for admission

STEMI WITH LYTICS

Checklist

- **ASA** 160 mg chewable (if not already given by EMS)
- **Plavix** 300 mg PO x1
- Confirm IV's x 2 (avoud Rt. wrist or hand)
- CBC with platelet count, INR, PTT, Lytes, Bun, Creatinine, Glucose, Troponin I, CXR
- **ADMINISTER THROMBOLYTICS AS PER PROTOCOL** (PPDO-PCS-62)
- **Heparin** IV bolus 60 U/KG (MAX OF 4000 UNITS) and **IV infusion** Do NOT use LMWH (Lovenox)

IF ANY QUESTIONS PLEASE CALL THE CARDIAC CATH LAB AT (807) 684-6675

STEMI WITH CONTRAINDICATIONS TO LYTICS

TREAT AS DIRECT STEMI

Checklist

- **ASA** 160 mg chewable (if not already given by EMS)
- **Plavix** 600 mg PO x 1 or **Prasugrel** 60 mg PO x 1
- **Heparin** IV bolus 60 U/kg (MAX OF 4000 UNITS) and IV **Infusion** DO NOT USE LMWH (Lovenox)
- Confirm IV's x 2 (avoid Rt. wrist or hand)
- CBC with platelet count, INR, Lytes, Bun, Creatinine, Glucose, Troponin I, CXR

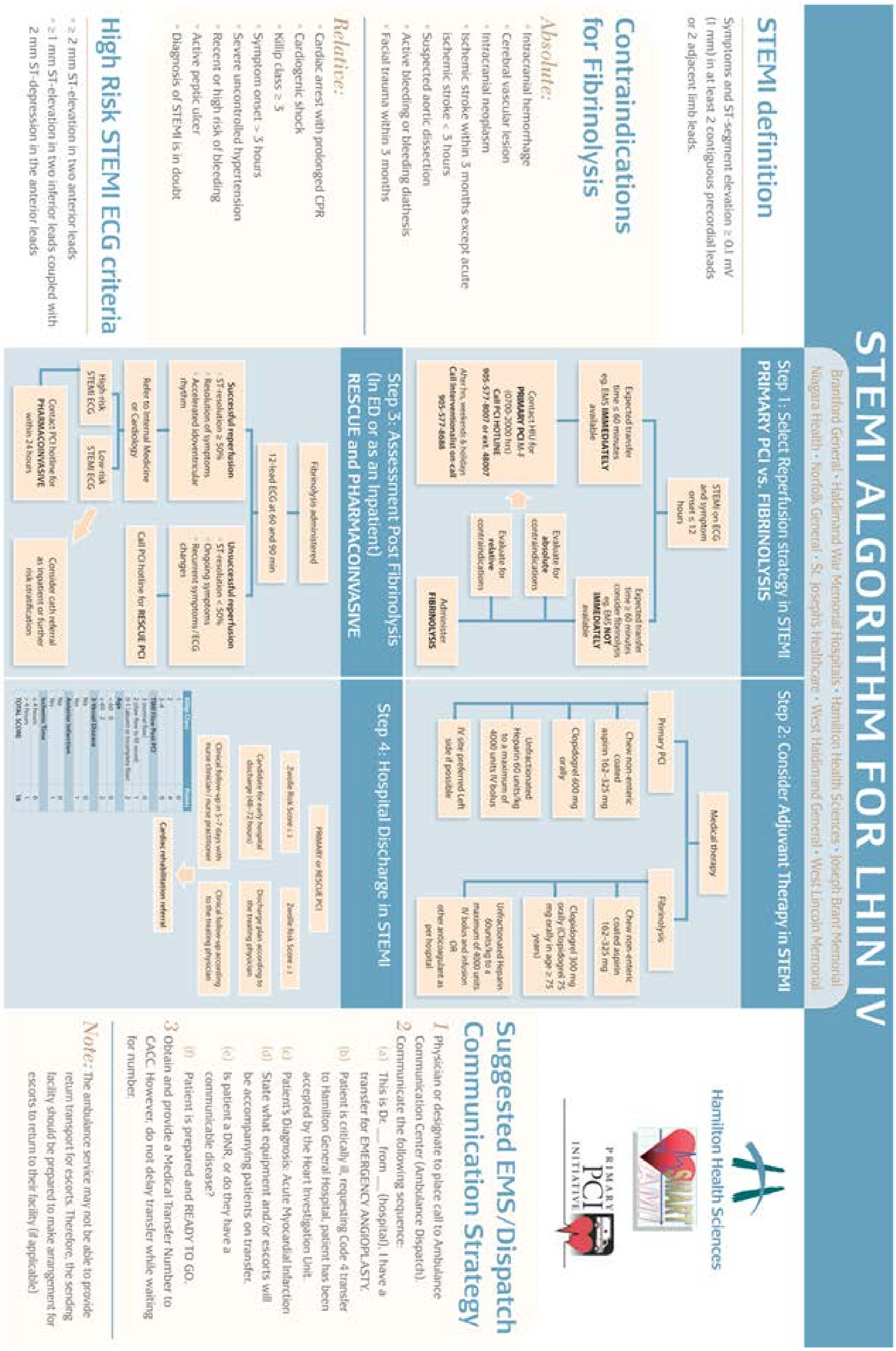
Call Interventional Cardiologist on call at TBRHSC (807) 684-6000

- Who will initiate CODE STEMI PROTOCOL through switchboard (ER secretary on night shift) who will page Cath Lab on call Team

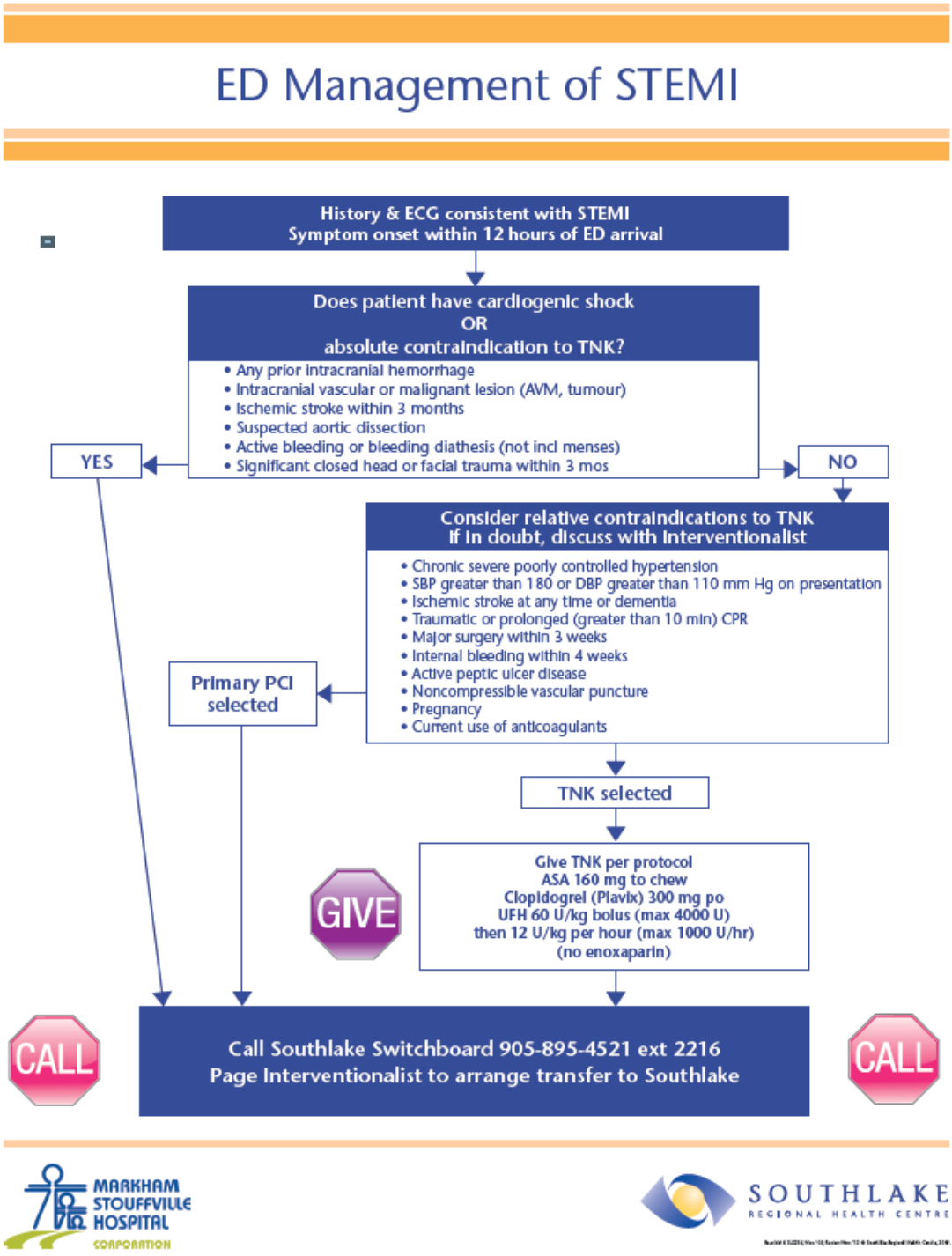
  0700 1800 CALL CATH LAB 684-6931

  1800-0700 PAGER 624-4334
- Notify ICU/Intensivist of patient admission

Hamilton Health Sciences



Southlake Regional Health Centre



Appendix B

CCN ACS Transfer Report

CARDIAC CARE NETWORK

SAMPLE

Acute Coronary Syndrome Transfer Report

Patient Name: _____

Health Card Number: _____

Date: _____

Contact Information	**Family/Band Contact Information**
TCHP Name: _____	Name: _____
TCHP Phone Number: _____	Phone Number: _____
Nursing Station Phone Number: _____	Name: _____
Nursing Station Fax Number: _____	Phone Number: _____

Patient Presentation Details

Onset of chest pain time: _____	MD on call contact time: _____
Arrival to nursing station time: _____	ECG faxed to MD on call time: _____
1st ECG time: _____	Diagnosis confirmed time: _____
Diagnostic ECG time: _____	

Clinical Assessment Findings

Allergies: _____

ECG changes: ☐ Anterior ST Changes ☐ (V1-V6) Lateral ST Changes (I,AVL) ☐ Inferior ST Changes (II, III, AVF) ☐ Left bundle branch block / ventricular paced rhythm ☐ Other

BP _____	HR _____	Baseline rhythm _____	O2Sat _____

Cardiac History: CAD ☐ Yes ☐ No Previous MI ☐ Yes ☐ No PCI: ☐ Yes ☐ No CABG ☐ Yes ☐ No

Heart failure class (NYHA): ☐ I ☐ II ☐ III ☐ IV ☐ Not applicable

Cardiac risk factors: HTN ☐ Yes ☐ No Diabetes ☐ Yes ☐ No Dyslipidemia ☐ Yes ☐ No

Patient height: _____ Patient weight: _____

Contraindications to Lytics: ☐ Yes ☐ No STEMI reperfusion achieved: ☐ Yes ☐ No

Treatments

Medications	Dose	Time	Administered by
Aspirin			
Antiplatelet: _____			
Fibrinolysis therapy: _____	_____ mg		
Anticoagulant: _____			
B Blockers: _____			
Nitroglycerin infusion IV	_____ mcg/min		
Nitroglycerin 0.4 mg SL			
Amiodarone			
Dopamine			
Other medications:			

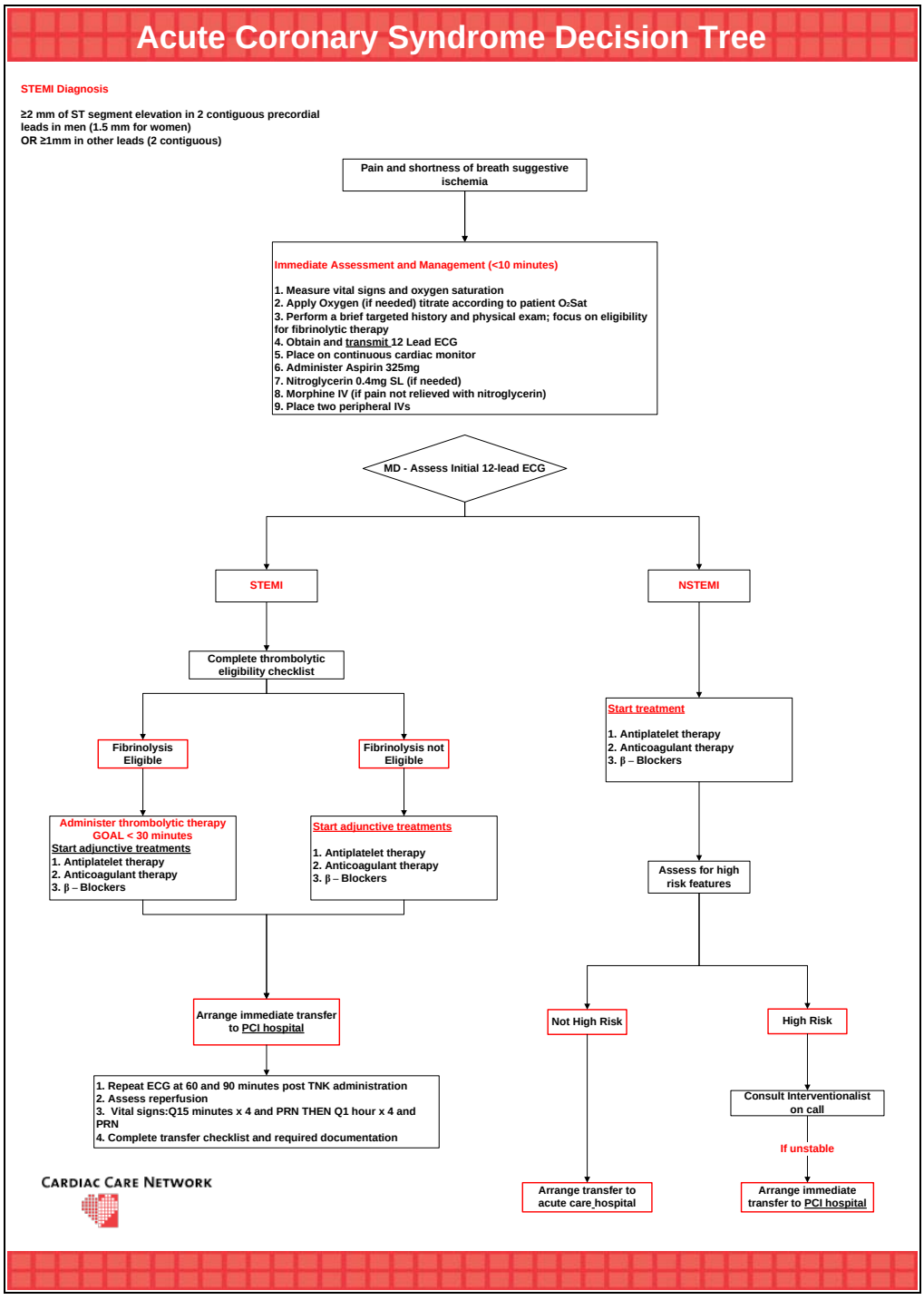
Transfer timelines

Air ambulance activation time: _____	Air ambulance arrival time: _____	Air ambulance departure time: _____

Adopted from Minneapolis Heart Institute

Appendix C

ACS Decision Tree



Appendix D

Other ACS Management Decision Aids and Checklists

Fibrinolysis Administration Guidelines

STEMI diagnosis Confirmed:

1. ≥2 mm of ST segment elevation in 2 contiguous precordial leads in men (1.5 mm for women)
2. ≥1mm in other leads (2 contiguous)

Assess Fibribolysis Eligibility

Absolute Contraindications

☐ Yes ☐ No Any prior intra cranial hemorrhage
☐ Yes ☐ No Known structural cerebral vascular lesion (e.g., arteriovenous malformation)
☐ Yes ☐ No Known malignant intracranial neoplasm (primary or metastatic)
☐ Yes ☐ No Ischemic stroke within 3 month EXCEPT acute ischemic stroke within 4.5 h
☐ Yes ☐ No Suspected aortic dissection
☐ Yes ☐ No Active bleeding or bleeding diathesis (excluding menses)
☐ Yes ☐ No Significant closed-head or facial trauma within 3 months
☐ Yes ☐ No Intracranial or intraspinal surgery within 2 months
☐ Yes ☐ No Severe uncontrolled hypertension (unresponsive to emergency therapy)
☐ Yes ☐ No For streptokinase, prior treatment within the previous 6 months

Relative Contraindications

☐ Yes ☐ No History of chronic, severe, poorly controlled hypertension
☐ Yes ☐ No Significant hypertension on presentation (Systolic Blood Pressure > 180 mm Hg or Diastolic Blood Pressure > 110 mm Hg)
☐ Yes ☐ No History of prior ischemic stroke > 3 months
☐ Yes ☐ No Dementia
☐ Yes ☐ No Known intracranial pathology not covered in absolute contraindications
☐ Yes ☐ No Traumatic or prolonged (> 10 min) cardiopulmonary resositation
☐ Yes ☐ No Major surgery (< 3 weeks)
☐ Yes ☐ No Recent (within 2 to 4 weeks) internal bleeding
☐ Yes ☐ No Noncompressible vascular punctures
☐ Yes ☐ No Pregnancy
☐ Yes ☐ No Active peptic ulcer
☐ Yes ☐ No Oral anticoagulant therapy

If no Contraindications Administer Fibrinolysis

Post Fibrinolysis Assessment and Monitoring

1. Vital signs: Q15 minutes x 4 and PRN THEN Q1 hour x 4 and PRN
2. Neurological assessment hourly x 2, THEN every 4 hours and as required
3. Continuous cardiac monitoring until transfer to an acute care hospital – post reperfusion arrhythmias may occur. Defibrillator and treatments should be immediately available.
4. Repeat ECG at 60 and 90 minutes post TNK administration – assess reperfusion
5. Patient should be on bed rest
6. Avoid IM injections or unnecessary disturbance of the patient (e.g. automatic blood pressure cuff)

Patient Education

Patient should be provided information on the drug including the potential side effects. Patient education should include the importance of reporting the following potential side effects:

1. Continuous chest pain
2. Sever headache or illogical thing and confusion
3. Significant back pain
4. Ecchymosis
5. Severe generalized weakness
6. Rash
7. Signs and symptoms of allergic reaction

CARDIAC CARE NETWORK

STEMI Transfer Checklist

- ❑ PCI Centre notified of a STEMI transfer. Nurse to nurse report should include:
    1. Name
    2. Date of birth
    3. Diagnosis
    4. Received treatments
    5. Medications
    6. Vital signs
    7. Reperfusion status
    8. Air ambulance activation time and estimated time of arrival
- ❑ Patient's clothing removed prior to transfer
- ❑ Transfer records include the following copied information:
    1. Nursing notes
    2. All 12 lead ECGs
    3. Transfer report
    4. Vital signs sheet
    5. Order sets
    6. Lab values (POCT)
- ❑ CCN data ready for entry into the database

CARDIAC CARE NETWORK

Appendix E

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Appendix F

Glossary of Terms

12-lead ECG – A procedure where leads are attached to patient's arms, legs and chest wall to record the electrical activity (rhythm) of the heart.

Advanced Cardiac Life Support (ACLS) – A specialty (certification) in advanced life support measures usually retested bi-annually.

AED – Automatic External Defibrillator is a portable electronic device that can diagnose potential life threatening arrhythmia and if needed defibrillate a patient.

Angioplasty (PTCA, PCI) – A technique used in the treatment of coronary artery diseases. The plaque that develops in the arteries of the heart is flattened against the arterial walls, resulting in improved circulation. The procedure involves threading a catheter through the coronary arteries to the location of the plaque and inflating and deflating a small balloon at the tip several times, then removing the catheter.

CABG (Coronary Artery Bypass Graft) – Heart surgery in which a procedure is done to bypass a narrowing or blockage in a coronary artery. This surgical procedure is used to restore blood flow around previously blocked arteries.

CIHI – Canadian Institute for Health Information

DAD – Discharge Abstract Database

Fibrinolytics (fibrinolysis therapy, fibrinolysis) – Medication given to dissolve clots in the immediate acute phase of myocardial infarction.

Ischaemic heart disease (coronary heart disease) – A type of heart disease caused by a lack of oxygen reaching the tissue cells. Angina is a common symptom of ischaemic heart disease.

Myocardial Infarction (MI) – Damage or necrosis of a region of the myocardium caused by an interruption in the supply of blood to the heart, usually as a result of occlusion of a coronary artery.

NSTEMI (Non ST Segment Myocardial Infarction) – On a 12-lead ECG, evidence of myocardial ischemia

Percutaneous Coronary Intervention (PCI) – see Angioplasty.

Primary PCIk – Performing acute angioplasty immediately for the treatment of a STEMI as the primary form of reperfusion.

Rescue PCI – Performing angioplasty for STEMI after fibrinolysis therapy has been given but where it has failed to reperfuse the infarct related artery. The decision to perform rescue PCI is generally made 60 to 90 minutes following the administration of fibrinolysis.

Reperfusion – The restoration of blood flow, as in coronary reperfusion, after administration of fibrinolysis therapy (drug).

Secondary prevention (of cardiovascular disease) – Relates to rehabilitative interventions, both physiological and behavioral, to minimize disease progression and reduce the risk of recurrent CV events.

STEMI (ST Elevation Myocardial Infarction) – On a 12-Lead ECG, evidence of myocardial damage causing ST segment elevation.

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