

Training Bulletin

STEMI Hospital Bypass

Issue Number 118 – Version 1.0
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**Emergency Health Services Branch
Ministry of Health and Long-Term Care**



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STEMI Hospital Bypass

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STEMI Hospital Bypass

Introduction

In Ontario, the frequency of ST-segment elevation myocardial infarctions (STEMIs) is approximately “68 of every 100, 000 adult residents, a total of about 7,000 STEMIs per year” (Cardiac Care Network [CCN], 2013, p. 5). In order to reduce mortality and morbidity, timely reperfusion is required (CCN, 2013).

This training bulletin provides paramedics a brief overview of coronary artery disease (including acute myocardial infarctions [AMIs]), STEMI treatment and STEMI diagnosis, and describes the role of Paramedic Services as it relates to STEMI patients. More importantly, it details the *STEMI Hospital Bypass Protocol* which will be an amendment to the current version of the *Basic Life Support Patient Care Standards*. Development of this bulletin and the *STEMI Hospital Bypass Protocol* has been made in consultation with the Cardiac Care Network (CCN), the Ontario Association of Paramedic Chiefs (OAPC), the Ontario Base Hospital Group Executive Committee (OBHG-Executive) the Ontario Base Hospital Group Medical Advisory Committee (OBHG-MAC), Toronto Paramedic Services (TPS) and Ornge.

Coronary Artery Disease

In Canada there is a death every seven minutes due to heart disease or stroke (Heart and Stroke Foundation, 2015); in 2008, myocardial infarctions made up 23% of deaths related to cardiovascular disease (Heart and Stroke Foundation, 2015). Further to this, most deaths caused by myocardial infarctions occur out-of-hospital (Heart and Stroke Foundation, 2015).

When plaque collects in the coronary arteries, coronary artery disease (CAD) may develop (CCN, 2013). This plaque build-up impedes the flow of blood through the coronary arteries. There is a multitude of risk factors associated with CAD, including age, sex, family history, sedentary lifestyle, diet, smoking, hypertension, and diabetes (CCN, 2013).

An AMI is caused when blood flow is suddenly stopped, primarily due to ruptured plaque creating a clot, thereby preventing blood from flowing through a coronary artery to an area of the heart (CCN, 2013). As a result, that area of the heart becomes oxygen deprived, which can lead to ischemia, which if not sufficiently treated, may cause necrosis.

STEMIs make up one third of acute coronary syndromes and are a more severe, time sensitive, type of MI. Timely and appropriate treatment of a STEMI patient is critical to preventing death.

STEMI Treatment

STEMI treatment requires timely reperfusion of the affected area of the heart, thereby restoring blood flow through the coronary arteries (CCN, 2013). Similar to treatment of a cerebrovascular accident (CVA), reperfusion time is “measured in minutes, not days or weeks” (CCN, 2013, p. 5). Two reperfusion interventions exist, which are acknowledged by the American College of Cardiology/American Heart Association (ACC/AHA) guidelines (CCN, 2013):

- *Percutaneous coronary intervention (PCI)*: use of a balloon or aspiration catheter to mechanically reopen an occluded coronary artery;
- *Fibrinolysis therapy*

PCI is preferred over fibrinolysis as it results in improved outcomes in terms of survival, reinfarction, cardiogenic shock and stroke; however appropriate STEMI treatment is dependent on time (CCN, 2013). ACC/AHA guidelines recommends a 90 minute or less door-to-balloon (D2B) time for patients who are transported directly to a PCI capable centre, and a 30 minute or less door-to-needle (D2N) time for patient being treated with fibrinolysis due to inaccessibility of a PCI capable centre (CCN, 2013). For patients who present at a non-PCI capable centre and require inter-facility transfer, a D2B time of 120 minutes or less is recommended (CCN, 2013).

In Ontario, a large proportion of residents have access to a PCI capable centre within a 60 minute drive time (CCN, 2013). Further to this, research shows that a 9-1-1 response decreases the overall time from symptom onset to diagnosis and treatment (CCN, 2013). The most recent data from CCN indicates that as of October 2015, sixteen PCI centres exist in the province providing all year, around the clock availability; however this number of centers may change over time (paramedics can refer to their Paramedic Service for details regarding local PCI centres and access information).

STEMI Diagnosis

Paramedic recognition of STEMI on the 12-lead ECG leads to reduced time to reperfusion and saves lives. Mortality is reduced by nearly one-third when paramedics recognize it early and transport directly for reperfusion – for either fibrinolysis or primary PCI (Welsford, 2015; Nam, 2014). In STEMI regional systems of care, although primary PCI is preferred when timely, where it is not immediately available, early fibrinolysis and intra-facility transport for PCI within 24 hours has been shown to have similar outcomes as primary PCI (Welsford, 2015; Mercuri, 2015).

Accurate diagnosis of a STEMI can be done through a clinical assessment and paramedic interpretation of a diagnostic 12-lead ECG (3-lead ECGs are **not** diagnostic for STEMI) (Le May, 2006; CCN, 2013). Complementary to the implementation of 12-lead ECGs in Paramedic Services across Ontario, training has been provided on their acquisition and interpretation, as well as decision making in determining STEMI, including identification of imitators.

Research shows that “multiple pre-hospital ECGs [are] superior to a single pre-hospital ECG” (Verbeek, 2012; CCN, 2013, p. 37). As per the OBHG-MAC, it is recommended that paramedics

repeat the 12-lead ECG in suspected cardiac ischemia cases if the initial 12-lead ECG does not demonstrate ST-segment elevation. The recommended times/locations for 12-lead acquisition are: after initial assessment, preferably prior to medication administration on scene; in the vehicle prior to leaving the scene; and, in the vehicle prior to entering the receiving facility.

Once a STEMI is confirmed, additional 12-lead ECGs are not recommended and emerging evidence shows that it may be appropriate for defibrillation pads to be placed on the patient due to the potential for lethal cardiac arrhythmias (Osei-Ampofo, 2015).

Role of Paramedic Services

“In 2011, the Ontario Ministry of Health and Long-Term Care (MOHLTC) asked the Cardiac Care Network of Ontario (CCN) to prepare an environmental scan of the diagnosis and management of STEMI patients in Ontario as a foundation for the development of a provincial strategy for this patient population” (CCN, 2013, p. 5). Included in CCN’s results were multiple priority recommendations, many of which had provisions for Paramedic Services and paramedics.

On February 1, 2016, the *Provincial Equipment Standards of Ontario Ambulance Services, Version 2.3* will be in force; included in this standard is the requirement for all cardiac monitors to: “have monitoring technologies with diagnostic measurements for ST segment analysis for 12-lead ECG acquisition” (Ministry of Health and Long-Term Care, 2015, p. 33). Patients diagnosed with a STEMI in the pre-hospital environment more often achieve the recommended D2B time when transported directly to a PCI capable centre than when patients are transferred between hospitals or brought to the emergency department of a PCI capable centre (Le May, 2008; Cheskes, 2011; CCN, 2013). With the inclusion of 12-lead ECGs in all Paramedic Services across Ontario, a provincial STEMI Hospital Bypass Protocol is now feasible.

STEMI Hospital Bypass Protocol

The *STEMI Hospital Bypass Protocol* is based on the most current *Ontario STEMI Bypass Protocol*, developed by CCN. CCN’s protocol was developed through the ST Elevation Myocardial Infarction – Emergency Medical Services Working Group (STEMI-EMS WG). The STEMI-EMS WG consisted of members including cardiologists, interventional cardiologists, emergency department physicians, base hospital medical directors, paramedic chiefs, paramedics, and administrators.

The *STEMI Hospital Bypass Protocol* is structured in a similar manner to the *Stroke Bypass Protocol*. Patients being assessed under the protocol must meet multiple indications, and may not meet any contraindications. **However, the *STEMI Hospital Bypass Protocol* recognizes that regional variance may exist between interventional cardiology programs.** As such, the *STEMI Hospital Bypass Protocol* includes a level of flexibility, through a procedure point in which the paramedic should attempt to determine if the interventional cardiology program at the PCI centre will still permit transport despite the presence of certain specified contraindications. In regions in which STEMI bypass has already been established with an interventional cardiology program, the

paramedic may refer to said program or contact the interventional cardiologist, if possible, to determine whether or not bypass may still occur, even in the presence of the specified contraindications. Further information regarding regional variance may be provided by the Paramedic Service and Base Hospital. Please be advised that Central Ambulance Communication Centres/Ambulance Communication Services (CACC/ACS) will maintain active lists of PCI capable centres and their contact information. CACC/ACS can be consulted in instances in which a paramedic is unsure of the distance to a PCI capable centre or their contact information.

The *STEMI Hospital Bypass Protocol* will be an amendment to the current version of the *Basic Life Support Patient Care Standards* (specifically, it will be contained within *Section 2 – Medical Patient Categories*). The protocol can be viewed in [Appendix A](#) of this training bulletin. In addition, a prompt card of the protocol can be viewed in [Appendix B](#); the prompt card is a quick reference of the protocol, but users should still refer to the protocol, as required.

Conclusion

Diagnosis of STEMI patients in the pre-hospital field leads to more effective care and results in better patient outcomes. This training bulletin reviewed STEMI-related topics, such as coronary artery disease, STEMI treatment, and STEMI diagnosis.

Paramedics can play an integral part in ensuring STEMI patients get the right care, at the right place, at the right time; the *STEMI Hospital Bypass Protocol* empowers such care.

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Appendix A – STEMI Hospital Bypass Protocol



STEMI Hospital Bypass Protocol

In situations in which the paramedic suspects that the patient is suffering from a STEMI, the paramedic shall:

1. assess the patient to determine if they meet all of the following indications:
 - a. ≥ 18 years of age;
 - b. experience chest pain or equivalent consistent with cardiac ischemia or myocardial infarction;
 - c. the time from onset of the current episode of pain < 12 hours; and
 - d. the 12-lead ECG indicates an acute AMI/STEMI, as follows:
 - i. At least 2 mm ST-elevation in leads V1-V3 in at least two contiguous leads;
OR
 - ii. At least 1 mm ST-elevation in at least two other anatomically contiguous leads; **OR**
 - iii. 12-lead ECG computer interpretation of STEMI and paramedic agrees.
2. if the patient meets the criteria listed in paragraph 1 above, assess the patient to determine if they have any of the following contraindications:
 - a. The patient is CTAS 1 and the paramedic is unable to secure the patient's airway or ventilate;
 - b. 12-lead ECG is consistent with a Left Bundle Branch Block (LBBB), ventricular paced rhythm, or any other STEMI imitator;
 - c. Transport to a hospital capable of performing percutaneous coronary intervention (PCI) ≥ 60 minutes from patient contact;
 - d. The patient is experiencing a complication requiring PCP diversion, as follows:
 - i. Moderate to severe respiratory distress or use of CPAP;
 - ii. Hemodynamic instability (*e.g.* due to symptomatic arrhythmias or any ventricular arrhythmia) or symptomatic SBP < 90 mmHg at any point; or
 - iii. VSA without ROSC.
 - e. The patient is experiencing a complication requiring ACP diversion, as follows:
 - i. Ventilation inadequate despite assistance;
 - ii. Hemodynamic instability unresponsive to ACP treatment or not amenable to ACP management; or
 - iii. VSA without ROSC.
3. notwithstanding paragraphs 2(c), 2(d), and 2(e) above, attempt to determine if the interventional cardiology program at the PCI centre will still permit the transport to the PCI centre;
4. if the patient does not meet any of the contraindications listed in paragraph 2 above **OR** the interventional cardiology program permits the transport to the PCI centre as per paragraph 3 above, inform the CACC/ACS of the need to transport to a PCI centre;
5. provide the PCI centre the following information as soon as possible:
 - a. that the patient is a "STEMI patient";
 - b. the patient's initials;
 - c. the patient's age;
 - d. the patient's sex;
 - e. the paramedic's concerns regarding clinical stability;
 - f. infarct territory and/or findings on the qualifying ECG;

- g. estimated time of arrival; and
 - h. catchment area of the patient pickup.
 6. upon arrival at the PCI centre, in addition to the requirements listed in the *Transfer of Responsibility for Patient Care Standard*, provide the following information to the PCI centre staff:
 - a. time of symptom onset;
 - b. time of ROSC, if applicable;
 - c. hemodynamic status;
 - d. medications given and procedure;
 - e. history of AMI/PCI/Coronary artery bypass graft (CABG), if applicable;
 - f. a copy of the qualifying ECG; and
 - g. a copy of the Ambulance Call Report (ACR), where possible.

***Note: Once initiated, continue to follow the STEMI Hospital Bypass Protocol even if the ECG normalizes after the initial assessment.**

Guideline

1. If intravenous access is indicated and established as per the *Advanced Life Support Patient Care Standards*, then the left arm is the preferred site.
 2. If the ECG becomes STEMI-positive enroute to a non-PCI destination, the patient should still be evaluated under this *STEMI Hospital Bypass Protocol*.
 3. If, in a rare circumstance, the PCI centre indicates that it cannot accept the patient (*e.g.* equipment failure, multiple STEMI patients), then the paramedic may consider transport to an alternative PCI centre as long as they still meet the *STEMI Hospital Bypass Protocol*.
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**Appendix B – STEMI Hospital Bypass Protocol
Prompt Card**

B

Paramedic Prompt Card for STEMI Hospital Bypass Protocol

This prompt card provides a quick reference of the *STEMI Hospital Bypass Protocol* contained in the *Basic Life Support Patient Care Standards* (BLS PCS). Please refer to the BLS PCS for the full protocol.

Indications under the STEMI Hospital Bypass Protocol

Transport to a PCI centre will be considered for patients who meet **ALL** of the following:

1. ≥ 18 years of age.
2. Chest pain or equivalent consistent with cardiac ischemia/myocardial infarction.
3. Time from onset of current episode of pain < 12 hours.
4. 12-lead ECG indicates an acute AMI/STEMI*:
 - a. At least 2 mm ST-elevation in leads V1-V3 in at least two contiguous leads; **OR**
 - b. At least 1 mm ST-elevation in at least two other anatomically contiguous leads; **OR**
 - c. 12-lead ECG computer interpretation of STEMI and paramedic agrees.

*Once activated, continue to follow the STEMI Hospital Bypass Protocol even if the ECG normalizes.

Contraindications under the STEMI Hospital Bypass Protocol

ANY of the following exclude a patient from being transported under the STEMI Hospital Bypass Protocol:

1. CTAS 1 and the paramedic is unable to secure patient's airway or ventilate.
2. 12-lead ECG is consistent with a LBBB, ventricular paced rhythm, or any other STEMI imitator.
3. Transport to a PCI centre ≥ 60 minutes from patient contact.**
4. Patient is experiencing a complication requiring PCP diversion:**
 - a. Moderate to severe respiratory distress or use of CPAP.
 - b. Hemodynamic instability or symptomatic SBP < 90 mmHg at any point.
 - c. VSA without ROSC.
5. Patient is experiencing a complication requiring ACP diversion:**
 - a. Ventilation inadequate despite assistance.
 - b. Hemodynamic instability unresponsive/not amenable to ACP treatment/management.
 - c. VSA without ROSC.

**The interventional cardiology program may still permit the transport to the PCI centre.

CACC/ACS will authorize the transport once notified of the patient's need for bypass under the STEMI Hospital Bypass Protocol.

