Provincial Clinical Knowledge Topic

ST-Elevation Myocardial Infarction (STEMI), Adult – Emergency Department

V 1.0

Revision History

Version	Date of Revision	Description of Revision	Revised By
1.0	June 2018	Version 1 of topic completed	see Acknowledgments

Important Information Before you Begin

The recommendations contained in this knowledge topic have been provincially adjudicated and are based on best practice and available evidence. Clinicians applying these recommendations should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care. This knowledge topic will be reviewed periodically and updated as best practice evidence and practice change.

The information in this topic strives to adhere to Institute for Safe Medication Practices (ISMP) safety standards and align with Quality and Safety initiatives and accreditation requirements such as the Required Organizational Practices. Some examples of these initiatives or groups are: Health Quality Council Alberta (HQCA), Choosing Wisely campaign, Safer Healthcare Now campaign etc.

Guidelines

This topic is based on the following guidelines:

1. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction[1]

2. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation (2017)[2]

Goals of Management

1. Early diagnosis of ST elevation myocardial infarction (STEMI) via early completion of 12-lead ECG in patients with symptoms suggestive of Acute Coronary Syndrome (ACS)
2. Early initiation of antiplatelet therapy, anti-ischemic, and analgesic therapy
3. Rapidly identify and initiate most appropriate reperfusion therapy
4. Initiation of antithrombotic therapy
5. Disposition to a service / centre capable of percutaneous coronary intervention (PCI)

Clinical Decision Support

Scoring and Assessment Tools

Table 1: ECG criteria suggesting a diagnosis of STEMI

1) <u>Upward-sloping ST segment elevation in 2 contiguous leads</u>

- In men, new ST elevation at the J point greater than or equal to 2 mm (0.2 mV) in leads V2-V3.
- In women, new ST elevation at the J point of 1.5 mm (0.1 5mV) in leads V2-V3
- In men or women, new ST elevation at the J point of greater than or equal to 1 mm in other contiguous chest leads or limb leads.
    - *Note: 'Contiguous leads' refers to lead groups such as anterior leads (V1-V6), inferior leads (II, III and aVF), or lateral/apical leads (I, aVL). Supplemental leads such as V3R/V4R reflect the free wall of the right ventricle and V7-V9 the infero-basal wall.*
    - **Be aware of pericarditis as a possible differential diagnosis as this is a contraindication to fibrinolysis**

2) <u>ST Depression in leads V1-V2:</u>

- In men or women, new ST depression at the J point of greater than or equal to 1mm in leads V1-V2 and ST elevation greater than 1 mm in a posterior lead V7-9.

****(15-lead ECG is also indicated in patients with evidence of ST-elevation in inferior leads to assess for right ventricular involvement [V4R])*

***** <u>New or presumed new left bundle branch block (LBBB):</u>**

- New/presumed new LBBB has traditionally been considered indicative of STEMI in patients with acute ischemic symptoms[3]
- Recent guidelines have questioned the value of 'presumed new' LBBB. Most patients do not have old ECG for comparison and presumed new LBBB is associated with a high false positive rate at diagnostic angiography. **ACC / AHA 2013 guidelines recommend not diagnosing STEMI on the basis of new/presumed new LBBB alone**[1]

Criteria have been developed for patients with suspected STEMI in the setting of LBBB (see Table 2) which provide high specificity and positive likelihood ratio but limited sensitivity[4].

Sgarbossa Criteria for STEMI in the setting of Left Bundle Branch Block (LBBB)

Online calculator may be found at:
https://www.mdcalc.com/sgarbossas-criteria-mi-left-bundle-branch-block

Table 3: Contraindications to Fibrinolysis in patients with STEMI

Absolute Contraindications	**Relative Contraindications** *(patient may be eligible if benefit outweighs risk)*
Any prior intracranial hemorrhage	Severe uncontrolled hypertension (Systolic BP GREATER than 180 and/or diastolic BP greater than 110 mmHg)
Known structural cerebral vascular lesion	History of chronic, severe, poorly controlled hypertension
Known intracranial neoplasm	Oral anticoagulant therapy
Ischemic stroke within last 6 months	Transient ischemic attack within 6 months.
Active bleeding	Traumatic or prolonged CPR
Suspected aortic dissection or pericarditis	Pregnancy
Known bleeding diathesis	Advanced liver disease
Recent major surgery with the last 3 weeks	Infectious endocarditis
Internal bleeding within 30 days	Active peptic ulcer disease
Non compressible vascular punctures	
Significant closed head or facial trauma in last 3 months	

Note: Thrombolysis is not indicated in patients whose ST elevation is not related to STEMI. This is particularly true of patients whose ST elevation is due to pericarditis, which poses a greater risk of hemorrhage and pericardial tamponade.

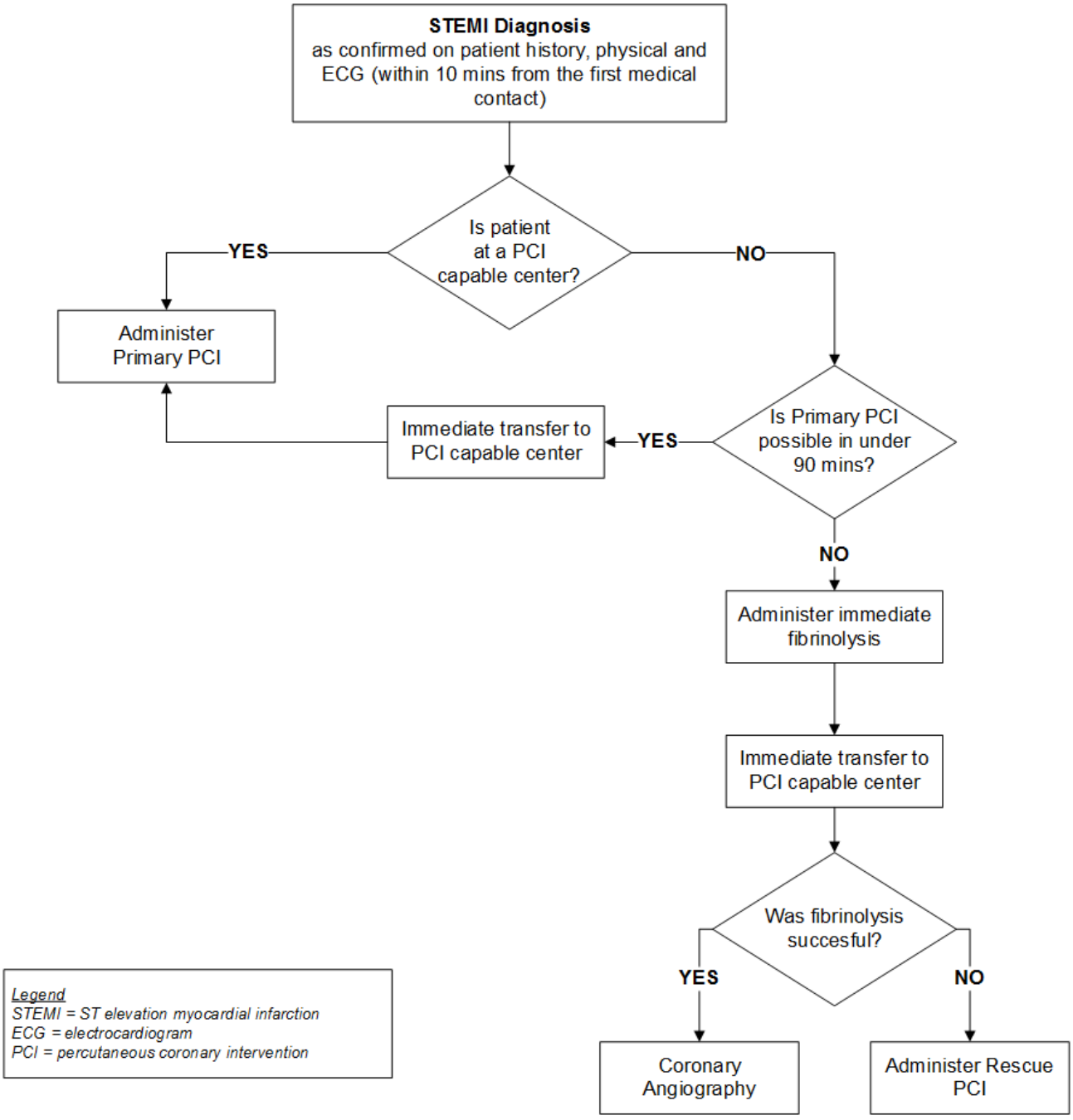
Table 4: Time benchmarks in the treatment of STEMI

Time Interval	Target
Maximum time from first medical contact (FMC) to ECG and diagnosis	LESS than 10 minutes
Maximum time from STEMI diagnosis to wire crossing in patients presenting at primary PCI capable centre	LESS than 60 minutes
Maximum time from STEMI diagnosis to wire crossing in transferred patients	LESS than 90 minutes
Maximum time from STEMI diagnosis to initiation of bolus of fibrinolysis in eligible patients unable to meet primary PCI target times	LESS than 10 minutes
Time interval from successful fibrinolysis to angiography	2 to 24 hours

Adapted from ESC STEMI Guidelines, 2017

Decision Making

Figure 1: STEMI Reperfusion decision making pathway



Adapted from: ESC 2017 STEMI Guidelines

Textual Decision Making Information

1. **Diagnosis:**
   - Identify patients at initial Emergency Department (ED) presentation who exhibit signs / symptoms suggestive of acute coronary syndrome (ACS) and obtain ECG within 10 minutes of first medical contact (FMC) to facilitate early diagnosis of STEMI
     - Clinicians should retain an index of suspicion for ACS even in the absence of classic ischemic chest pain, especially in patients who are elderly, female, and/or diabetic. See Table 1 and Table 2, for regarding diagnostic aids for STEMI

2. **Initial Care:**
   - Hemodynamic instability must be addressed with emergent reperfusion (see below)**.** It is important to consider mechanical causes of hemodynamic instability (Myocardial wall rupture, papillary muscle rupture, etc.) and the need for an urgent diagnostic echocardiogram. Additional supportive therapies may include intravenous fluids, vasoactive medications, and/or mechanical support, tailored to the individual patient circumstances. Norepinephrine is preferred over dopamine in patients with cardiogenic shock requiring vasoactive medical therapy due to a lower risk of death and cardiac arrhythmias.
   - Patients with symptoms and/or ECG suggestive of ACS should receive acetylsalicylic acid (ASA) 160 mg chewed in the absence of a history of true acetylsalicylic acid (ASA) allergy
     - See ***Chest Pain, Suspected Cardiac, Adult - Emergency Department Clinical Knowledge Topic***
   - Nitrates may be titrated to relieve symptoms of ischemia and/or pulmonary edema in patients who are not hypotensive and who have not recently taken a phosphodiesterase inhibitor type 5 (e.g. sildenafil within 24 hours, tadalafil within 48 hours). Nitrates should generally be avoided in the setting of right-ventricular ischemia.
   - Oxygen should be administered to patients with room air saturations less than 90%. Patients who are not hypoxic should not receive supplemental oxygen.
   - Opiates may be considered for additional analgesia

3. **Reperfusion:**
   In patients identified to have STEMI, immediately determine the most appropriate reperfusion therapy (thrombolysis or primary PCI), taking into account contraindications to thrombolysis (see Table 3) and relevant time delays to initiating primary PCI (see Figure 1)

   - **Reperfusion therapy should be administered to all patients with symptoms of less than 12 hours duration and evidence of ongoing ischemia**. Treatment for patients with 12 to 24 hours of symptoms may also be considered, especially if symptoms were stuttering or if there is evidence of active ischemia on ECG; consider consulting with the on-call cardiologist in these cases.

   - **Primary PCI is the preferred method of reperfusion when it can be performed expeditiously**:
     - Primary PCI is generally preferred over thrombolysis when the anticipated time from first medical contact (FMC) to PCI is LESS than 120 minutes. If primary PCI is selected for reperfusion, the target 'FMC to wire crossing' time is LESS than 60 minutes in a PCI capable center, and LESS than 90 minutes at non-PCI capable centres (see Table 4 and Figure 1).

- Individual patient factors (age, size of myocardium at risk, duration of symptoms, and hemodynamic stability) should be taken into account when determining the acceptable delay to primary PCI. Younger patients with acute presentations and a large area of involved myocardium might have acceptable delay times of LESS than 60 to 90 minutes, and thrombolysis may be preferred if the delay to PCI is longer than this (see Table 4 and Figure 1). On the other hand, patients with delayed presentations (especially with GREATER than 6 hours of symptoms) and those in cardiogenic shock might receive greater benefit from primary PCI even if the delay is more than 120 minutes. Consider discussing with the on-call interventional cardiologist in these cases.

- **Fibrinolysis should be considered for reperfusion therapy in patients with LESS than 12 hours of symptoms in whom the time from FMC to PCI is anticipated to be GREATER than 120 minutes, and in whom there are no contraindications to its use** (see Table 3)**:**
  - As mentioned above, individual patient factors must be taken into consideration. Older age, delayed presentations, and/or smaller area of involved myocardium may all prompt stronger consideration of primary PCI even if the FMC to PCI time is greater than 120 minutes. Consider discussing with the interventional cardiologist on call in these cases.
  - If Fibrinolysis is given, it is important to continue neuro vital signs hourly (to detect intracranial hemorrhage), avoid invasive procedures, and observe the patient for bleeding or bruising.
  - If Fibrinolysis is given, it is important to monitor for clinical and ECG evidence of reperfusion. Clinical evidence of reperfusion centers around resolution of the patient's presenting symptoms. ECG evidence of reperfusion centers around the normalization of ST-segment and the presence of one (or more) arrhythmias, which are usually ventricular.

4. **Antiplatelet Therapy:**
   As mentioned above, all patients without true acetylsalicyic acid (ASA) allergy should receive chewable acetylsalicylic acid (ASA) 160 mg PO once followed by ASA enteric coated 81 mg PO daily. Additional antiplatelet therapies in the ED should be administered based on individual patient circumstances:
   - **Primary PCI:**
     (choose one; ticagrelor preferred):
     - ticagrelor 180 mg PO once, before or at time of PCI, **and then** 90 mg PO BID
       OR
     - clopidogrel 600 mg PO once, before or at time of PCI, **and then** 75 mg PO daily

   - **Fibrinolysis:**
     - Age LESS THAN 75 years: clopidogrel 300 mg PO once **and then** 75 mg PO daily
       OR
     - Age 75 years or older: clopidogrel 75 mg PO daily (no loading dose)

5. **Anticoagulant Therapy:**
   - **Primary PCI:**

     EITHER:
     - unfractionated heparin IV bolus dose (70 units/kg) followed by infusion. *Unfractionated heparin infusion dosing will depend on whether GPIIb/IIIa inhibitor use is planned during primary PCI and thus should be discussed with the interventional cardiologist.*

     OR
     - enoxaparin 0.5 mg/kg IV bolus once

   - **Fibrinolysis:**

     EITHER:
     - Enoxaparin:
       - Age LESS THAN 75 years: enoxaparin 30 mg IV bolus followed 15 minutes later by 1 mg/kg subcutaneously every 12 hours (max 100 mg for first 2 doses)
         OR
       - Age 75 years or older: enoxaparin 0.75 mg/kg subcutaneously every 12 hours (max 75 mg for first two doses); no bolus dose.

     OR
     - Unfractionated heparin:
       - Unfractionated heparin (60 units/kg) IV bolus once (maximum 4000 units/dose) **and then** unfractionated heparin (12 units/kg/hour) IV infusion to a maximum of 1000 units/hours according to local protocol for 48 hours or until reperfusion (see Table 6 for dosing or refer to local monitoring protocols)

6. **Additional Therapy:**
   - **Beta blockers** should be administered orally within the first 24 hours of presentation with STEMI if there are no contraindications (acute heart failure, cardiogenic shock/hypotension, second/third-degree heart block, severe first-degree heart block, active asthma). It is reasonable to administer IV beta blockers to patients with STEMI who are hypertensive with ongoing ischemia in the absence of contraindications.

7. **Disposition:** (see Figure 1), and text above, for guidance regarding initial transfer decisions for primary PCI. In patients who are treated with fibrinolysis, transfer to a PCI-capable centre may also be considered, as follows:
   - Patients who develop cardiogenic shock or severe heart failure, or those with clinical and ECG evidence of failed reperfusion should be transferred as quickly as possible to a PCI-capable centre
   - Patients who successfully reperfused after fibrinolytic therapy should be transferred for angiography within 3 to 24 hours.

Order Set

Please refer to Provincial Order Set form found at:
https://www.albertahealthservices.ca/frm-ch-0454.pdf

Admission/Transfer/Discharge Planning

1. Generally speaking, all patients with STEMI whose Goals of Care designation is appropriate for PCI will be admitted to a PCI-capable centre. However, regions with established care pathways for STEMI patients (e.g. Vital Heart) should continue to use these resources if available.
2. Patients receiving medical therapy only may be admitted at a non-PCI-capable centre
3. Patients receiving palliative care only may be suitable for discharge if their symptoms can be adequately managed in an outpatient setting

Prepare for Immediate Transfer: Call RAAPID

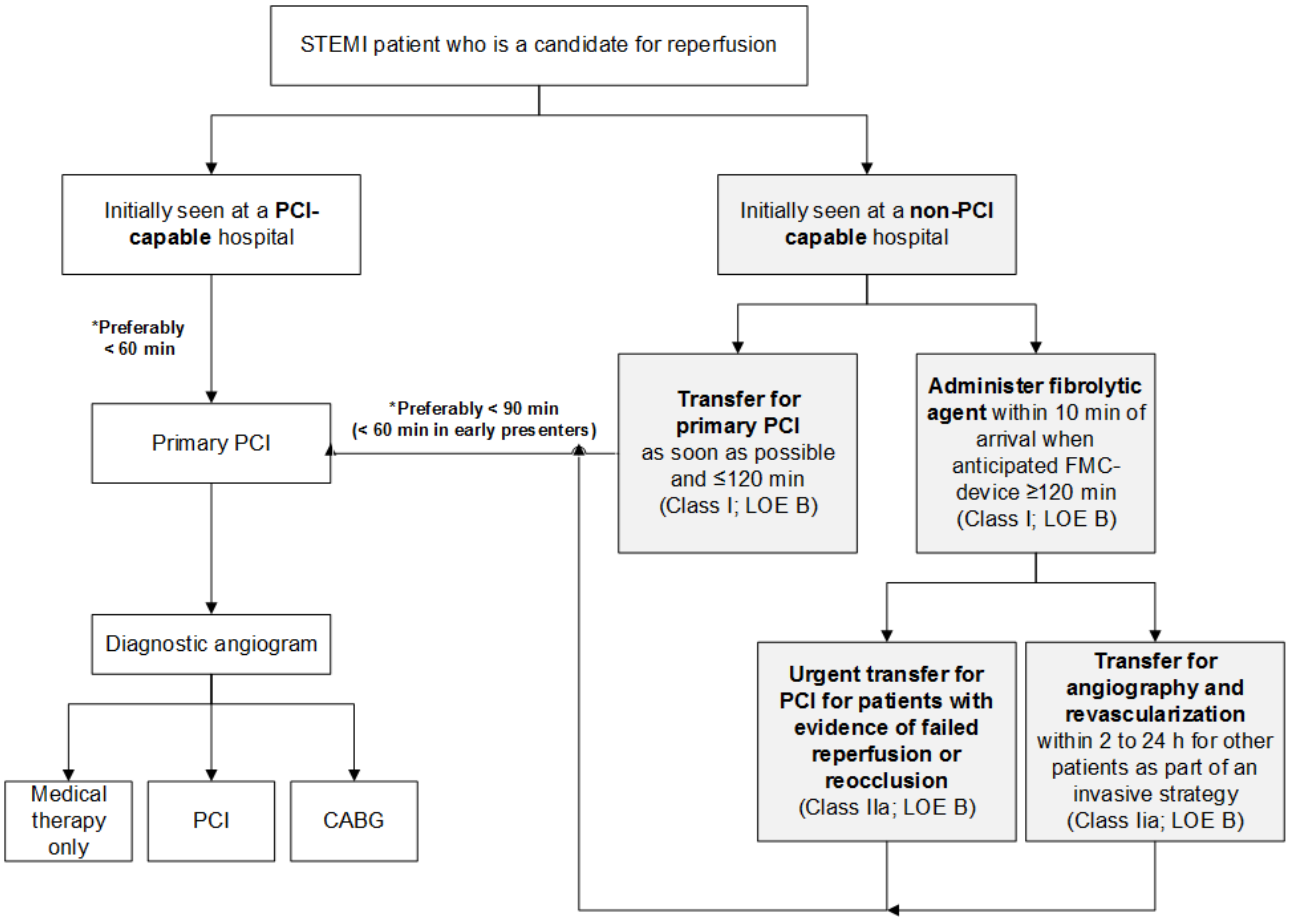
Call and consult Cardiology for admission: Prepare for Immediate Transfer
RAAPID North 1-800-282-9911 RAAPID South 1-800-661-1700

- Fax ECG to RAAPID North or South (fax number) _____
- Include copies of the following items with patient transport
    - RN notes and medication records
    - Transfer record, and copy of this STEMI order set with times completed
    - ED Physician notes
    - All EMS notes (if applicable)
    - All ECGs (ensure date and time is on them). Time of first ECG _____ *(hh:mm)*
    - ED Physician and Cardiac Interventionalist consult from RAAPID
    - Fax documents not sent with patient transport to the receiving department
    - Ensure all medications are given prior to leaving site OR ensure EMS can administer on transfer.
- **Note: If there is a delay in transport or a change in patient status call RAAPID - Cardiology for further orders.**

References

1. O'Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2013;127:e362–e425.
2. Ibanez B, James S, Agewall S, Antunes MJ, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J. 2017;doi:10.1093/eurheartj/ehx393.
3. Steg PG, James SK, Atar D, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J*. 2012;33(20):2569-619.
4. Tabas JA, Rodriguez RM, Seligman HK, Goldschlager NF. Electrocardiographic criteria for detecting acute myocardial infarction in patients with left bundle branch block: a meta-analysis. *Ann Emerg Med.* 2008;52(4):329-336.
5. Sgarbossa EB, Pinski SL, Barbagelata A, et al. Electrocardiographic diagnosis of evolving acute myocardial infarction in the presence of left bundle branch block. GUSTO-1(Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries) Investigators. *N Engl J Med*. 1996;334:481-487.

Rural Considerations



Outside of the Greater Edmonton and Calgary areas, provided the Angiography suite is available, nearly all cases of STEMI will proceed to Fibrinolysis prior to transfer to a PCI capable centre.

Analytics

1. Selection of anticoagulants for a given patient population in the setting of STEMI
2. Rates of MACE (Major Adverse Cardiovascular Event) within 30, 60, and 90 days
3. Time to Thrombolysis for eligible candidates presenting in the community
4. Time to PCI
5. Time to initial ECG
6. Time to initial Acetylsalicylic acid dose

Clinical Questions

Clinical Question #1: Is there a role for pantoprazole therapy to prevent GI bleeding in view of multi-agent anticoagulation. Should we be recommending it?

Clinical Recommendation #1:

We suggest in favor of using proton pump inhibitors for reducing the number of GI bleeding events in patients receiving (multi-agent) antiplatelet therapy.

Quality of Evidence: Moderate, GRADE B
Strength of Recommendation: Weak, GRADE 2

References:

1. M. Vaduganathan, D.L. Bhatt, B.L. Cryer, et al. Proton-pump inhibitors reduce gastrointestinal events regardless of aspirin dose in patients requiring dual antiplatelet therapy. *J Am Coll Cardiol*. 2016;67(14):1661-1671.
2. Melloni C, Washam JB, Jones WS, et al. Conflicting results between randomized trials and observational studies on the impact of proton pump inhibitors on cardiovascular events when coadministered with dual antiplatelet therapy: systematic review. *Circ Cardiovasc Qual Outcomes*. 2015;8(1):47-55.
3. Cardoso RN, Benjo AM, DiNicolantonio JJ, et al. Incidence of cardiovascular events and gastrointestinal bleeding in patients receiving clopidogrel with and without proton pump inhibitors: an updated meta-analysis. *Open Heart*. 2015;2:e000248-e. DOI: 10.1136/openhrt-2015-000248.
4. Gralnek IM, Dumonceau JM, Kuipers EJ, et al. Diagnosis and management of nonvariceal upper gastrointestinal hemorrhage: European Society of Gastrointestinal Endoscopy (ESGE) Guideline. *Endoscopy*. 2015;47(10):a1-46.
5. Laine L , Jensen DM. Management of patients with ulcer bleeding . *Am J Gastroenterol*. 2012;107:345-360.

Clinical Question #2: Use of Nitroglycerin in the setting of a presumed right ventricular infarction. Is it an absolute contraindication or not?

Clinical Recommendation #2:

We suggest the use of nitroglycerin in presumed right ventricular infarction should *generally* be avoided.

The original guideline recommendation (that nitroglycerin is contraindicated in this population group) appears to be based on ‘consensus’ (lowest quality of evidence). Many guidelines found in the literature search state nitroglycerin is contraindicated in this population but provide no reference to support the statement. There are no systematic reviews, meta-analyses, or good quality randomized controlled trials to support or refute this clinical question.
The definition of ‘hypotension’ is inconsistent (varies anywhere from systolic blood pressure of 80 mmHg to < 110mm Hg), or not defined at all. Timing of nitroglycerin start is inconsistent or not defined at all and dose and rate of nitrates/nitroglycerin also varies, or is not defined at all.

Quality of Evidence: Low, Grade C
Strength of Recommendation: Weak, Grade 2

References:

1. Proulx MH et. al. Prehospital Nitroglycerin in Tachycardic Chest Pain Patients: A Risk for Hypotension or Not? *Prehosp Emerg Care*. 2017 Jan-Feb;21(1):68-73
2. Robichaud L et. al. Prehospital Nitroglycerin Safety in Inferior ST Elevation Myocardial Infarction. *Prehosp Emerg Care*. 2016;20(1):76-81
3. Goldstein JA. Pathophysiology and management of right heart ischemia. *J Am Coll Cardiol.* 2002; 40:841–853
4. Ferguson JJ et. al. Significance of nitroglycerin-induced hypotension with inferior wall acute myccardial infarction. *Am J Cardiol*, 64 (1989), pp. 311-314
5. Jaffe AS, Geltman EM, Tiefenbrunn AJ, Ambos HD, Strauss HD, Sobel BE, Roberts R: Reduction of infarct size in patients with inferior infarction with intravenous glyceryl trinitrate. A randomized study. *Br Heart J* 1983;49:452-460
6. Jugdutt BI, Warnica JW: Intravenous nitroglycerin therapy to limit myocardial infarct size, expansion, and complications: Effect of timing, dosage, and infarct location. *Circulation* 1988;78:906-919

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Thank you to all provincial stakeholders who participated in the review process for this topic. Your time spent reviewing the knowledge topics and providing valuable feedback is appreciated.

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