6228.03: Chest Pain

INTRODUCTION

Though this guideline is entitled "Chest Pain", the approach outlined here also applies to etiologies that typically present with chest pain or discomfort, but not necessarily. For instance, in the setting of acute coronary syndromes (ACS) it is common that actual pain is absent, and instead the symptoms consist of more vague complaints such as pressure, tightness, or heaviness. Actual chest symptoms may be completely absent, and symptoms instead can be referred to the arms, neck, back, or abdomen. Patient history and physical exam findings will help the clinician develop a differential diagnosis. The process of collecting information in order to differentiate the nature of the symptoms is critically important in order to determine the best treatment pathway for the patient.

Over the past decade there have been several advancements made in the pre-hospital care of patients complaining of chest pain, in particular regarding acute coronary syndromes (ACS). Treatments once considered only in the domain of the hospital emergency department (ED) and coronary care unit (CCU) are now becoming standard of care for pre-hospital providers.

Public awareness of the signs and symptoms of ACS and early activation of EMS are crucial steps in the development of better care.

Though early recognition of possible ACS is always critical, it is important to recall that the differential diagnosis for emergency causes of chest pain, or chest pain equivalent presentations, is broad and extends beyond ACS.

SAFETY

Some causes of chest pain are respiratory in nature and may be caused by infectious diseases such as tuberculosis or pneumonia. Clinicians should wear appropriate personal protective equipment when etiologies such as these are suspected.

ASSESSMENT

Chest pain presents a diagnostic challenge, with multiple etiologies having similar presentations.
Assessment begins by looking at the general appearance of the patient, such as position, level of distress (if any), and skin condition (e.g. pallor, diaphoresis).

In patients presenting with chest pain, a detailed symptom history, focused physical examination, and directed risk factor assessment (e.g. risk factors for ACS or pulmonary embolus) should be performed. Critical components of the chest pain assessment include:

- Time of symptom onset
- Detailed assessment of the pain (OPQRST)
- Associated symptoms
- Current medications, including those that may impact care (e.g. Viagra)
- Cardiac risk factors
  - Smoking
  - Hypertension
  - Dyslipidemia
  - Diabetes
  - Family history of coronary artery disease (CAD)
  - Stimulant drug use (e.g. crack/cocaine)
- Urgent 12-lead ECG within 10 minutes of patient contact
- Serial 12-lead ECGs every 15-30 minutes if ongoing or evolving symptoms
- 15-lead ECG (or modified 12-lead ECG) when indicated

In addition to general appearance, a focused physical exam should include assessment of ABCs, cardiac and respiratory exams.

With this information, the paramedic should focus on developing a differential diagnosis based on time sensitive emergencies.

Differential Diagnoses

The above history and physical exam involves assessing for the most serious causes such as ACS, thoracic aortic dissection, tension pneumothorax, ruptured esophagus, and pulmonary embolism. By elimination or confirmation of the most serious causes, further assessment can be done to determine the potential origin of the pain. See Figure 1 for differential diagnoses.

Always have a high index of suspicion that any chest pain is cardiac in origin. Signs and symptoms suggestive of ACS include:

- Chest discomfort spreading to the shoulders, neck, arm(s), jaw, back or between the shoulder blades
- Unexplained sudden shortness of breath

- Uncomfortable pressure, fullness, squeezing, heaviness or pain in the center of the chest lasting more than a few minutes
- Light-headedness, dizziness, fainting, sweating/diaphoresis, nausea, or vomiting
- Exertional chest pain

Remember that ACS patients do not necessarily present with 'chest pain'. Women, people with diabetes, and the elderly often have atypical presentations such as indigestion, back pain, syncope and/or chest wall type pain.

Pain that changes on inspiration or palpation can be present with musculoskeletal or pulmonary etiologies and is not typical of cardiac-related symptoms; however, the presence of these features cannot be used to rule out ACS.

Many causes of cardiovascular-related chest pain show changes on the 12-lead ECG. Myocardial infarction may show ST segment elevation, but ischemia or infarction can also demonstrate ST segment flattening or depression, T-wave inversion, biphasic T-waves, peaked T-waves or a new Left Bundle Branch Block. **It is also important to note that a normal ECG does not rule out ACS; stable angina, unstable angina, and NSTEMI commonly present with a normal or unchanged ECG.**

A 15-lead/modified 12-lead ECG should be obtained for some patients to determine if there is right ventricular and/or posterior myocardial ischemia or infarction. If there is ST elevation present in one or more inferior leads (II, III or aVF) or ST segment changes present in V1 & V2, a modified 12-lead is indicated to assess for inferior and/or posterior MI. See Figures 2 and 3 for normal ECG lead characteristics and STEMI recognition criteria.

Some other conditions that can cause ST segment changes on 12-lead ECG include ventricular hypertrophy, paced rhythms, benign early repolarization (BER), bundle branch blocks, myocardial contusions, pericarditis, Brugada syndrome, aneurysms, arrhythmias, electrolyte abnormalities, pulmonary embolism, electrocution, toxicologic causes, and stroke/brain hemorrhage. Obtaining a good patient history will allow the clinician to narrow down the list of causes for ECG changes.

Musculoskeletal-type pain often feels sharp and stabbing, and it gets worse with movement and/or palpation of the area. These patients usually have an identifiable mechanism of injury or cause. Costochondritis typically presents with intermittent dull and sharp pain in the middle on the chest, with increasing pain on palpation, movement, and inspiration.

Pleuritic-type pain is pain that is worse on inspiration. If the pleuritic pain is due to infection, such as *pneumonia*, the patient may have a productive cough, chills and/or an elevated temperature. A *spontaneous pneumothorax* classically presents with pleuritic pain. There may be associated shortness of breath and/or unilateral decreased breath sounds, though this finding is generally insensitive unless the pneumothorax is relatively large.

A *pulmonary embolism* (PE) will classically present with pleuritic chest pain and/or shortness of breath, and may also present with syncope. Risk factors for PE are based on the Well's Criteria, and include recent immobility for an extended period of time (e.g. recent long flight or surgery), active cancer, personal or family history of deep vein thrombosis (DVT)/PE, hemoptysis, or recent swelling and/or pain of the lower extremities (indicative of a DVT).

Pericarditis pain is also classically pleuritic, and increases with lying down and gets better when leaning forward. If the pericardial effusion often associated with pericarditis becomes large enough, it may also present with cardiac tamponade. Pericarditis can cause widespread ST segment elevation on EKG, and cardiac tamponade may cause low voltages or electrical alternans.

Aortic dissection may present with chest pain and/or thoracic back pain. It may be ripping/tearing but not necessarily. There may be associated syncope, congestive heart failure, or extremity weakness. The blood pressure may be different in both arms. Keep in mind this is a completely different pathology than aortic aneurysm, and the two conditions are often confused.

A *ruptured esophagus* presents with chest pain in the setting of recent forceful vomiting. It is relatively rare but a true emergency. Findings may also include subcutaneous emphysema, crackles on lung auscultation and fever.

Keep in mind that chest pain may be secondary to abdominal etiologies as well. Be sure to assess the abdomen for patient's complaining of chest symptoms.

MANAGEMENT

Successful management of chest pain requires knowledge of treatment options, and clinical competence to provide appropriate care.

Cardiovascular Chest Pain

Ischemic causes

General care of ischemic chest pain includes the administration of:

- ASA for even mild/moderate suspicion of possible ACS **(PEP 1 supportive)**
- Nitroglycerin prn **(PEP 1 supportive)**
- Morphine/fentanyl prn **for extreme discomfort only** that is not relieved with nitroglycerin. Otherwise avoid use of narcotics for ACS in light of most recent evidence suggesting possible harm [**PEP 2 against** (routine use of narcotics)**]**
- Oxygen prn to maintain SpO_2 between 94-96%. Avoid both hypoxia (SpO_2 less than 90%) AND hyperoxia (SpO_2 higher than 99%) to avoid harm [**PEP 1 against** (routine use of high flow oxygen)**]**
- Plavix (if going direct-to-PCI or receiving pre-hospital fibrinolysis) **(PEP 1 supportive)**

The primary goals of therapy for ACS are:

- Treat acute, life-threatening complications of ACS (e.g. unstable arrhythmias and cardiogenic shock)
- Select the most appropriate reperfusion strategy for STEMI patients and **minimize delays to reperfusion**.
- Anti-platelet administration
- Manage symptoms, supportive care

With these goals in mind, there have been various pre-hospital initiatives put in place such as ECG interpretation, direct-to-PCI directives, and pre-hospital fibrinolysis to help expedite diagnosis and treatment of ACS.

STEMI-Specific Care

Once it is determined that a patient meets criteria for reperfusion therapy, as outlined on the STEMI Reperfusion Worksheet, follow the checklist and process outlined on this worksheet.

There are two reperfusion options for STEMI care in Nova Scotia, depending primarily on whether or not the patient is located within the catchment are for Direct-to-PCI. Reperfusion options are considered in consultation with the ED Charge Physician at the closest Regional Hospital or Tertiary Care Centre (Halifax Infirmary - HI).

Option A: Direct-to-PCI **(PEP 1 supportive)**
The goal is to have the patient arrive at the QEII within 60 minutes from the diagnostic ECG. This is done in order to obtain an ECG to balloon time of ideally less than 90 minutes, and ensure that the vast majority of cases are reperfused within 120 minutes from the diagnostic ECG in keeping with Canadian Cardiovascular Society (CCS) Guidelines.

Option B: Early Fibrinolysis **(PEP 1 supportive)**
If the direct-to-PCI option is not obtainable due to geography or other circumstances, the goal is to administer TNK within 30 minutes from diagnostic ECG. Lovenox is also administered to these patients. When in close proximity to an emergency department, consider rapid transport for in-hospital fibrinolysis as an alternative.

STEMI patients with cardiogenic shock (e.g. hypoperfusion, hypotension, and/or pulmonary edema) fare better with PCI, even if it is delayed, rather than fibrinolysis. Consider activating Air Medical Transport (AMT) if the patient is located further than 60 minutes from the QEII. AMT may not make a scene landing, but can begin the process of planning a coordinated transfer. In these cases, continue with the process of possible fibrinolysis in consultation with the appropriate Regional Hospital.

Undifferentiated Chest Pain

Treatment of patients with undifferentiated chest pain will be supportive and/or corrective based on the patient's presentation and needs. This may include:

- Continuous cardiorespiratory monitoring
- Providing oxygen to maintain SpO_2 between 94-96%
- Maintaining BP>90 systolic with IV fluids as needed
- Obtaining 12-lead ECG(s). Serial ECGs are important for patients with ongoing symptoms and prolonged patient contact. Serial EKGs every 30 minutes for ongoing symptoms is recommended.
- Regular reassessments of vital signs and clinical picture
- Considering analgesia
- Placing patient in position of comfort

If a specific etiology is found, they should be managed as per the relevant Clinical Practice Guideline(s).

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Transport Decision

As chest pain can be caused by a wide-variety of potentially serious conditions, most of which cannot be ruled out in the field, patients should be transported to a hospital as soon as possible.

Patients with chest pain are at high risk for poor outcomes and relapsing to 9-1-1 if not transported. Because pre-hospital clinicians are unable to rule out life threatening causes of chest pain in the field, it is not advisable to reassure patients that their chest pain is benign and/or suggest that transport is not necessary. Always consult the appropriate online support if a patient does not want to be transported by ambulance. The Non-Transport/Refusal of Care Clinical Practice Guideline should be followed in these circumstances.

TRANSFER OF CARE

- Transfer of care for STEMI patients going Direct-to-PCI occurs in the HI ED when the patient has an unstable airway or hemodynamics. If the Cath Lab is ready on arrival and the patient is stable then transfer of care happens in the Cath Lab itself. If the patient is stable, but the Cath lab is not ready, the patient is taken to the STEMI bed in the CCU but transfer of care does not occur here. Care in the STEMI bed is collaborative with CCU staff and the EHS crew. The EHS clinicians should remain with the patient throughout the stay in the STEMI bed, provide ongoing care as per CPGs/reperfusion worksheet, and transfer the patient to the Cath Lab once they are ready.
- If going straight to the STEMI bed in the CCU from the field, remember to call the CCU on arrival at the HI from the ambulance bay. Care in the STEMI bed is collaborative with CCU staff and the EHS crew. Refer to the STEMI bed process map in the HI ambulance bay.
- Early notification of ED staff via radio patch is essential to ensure the continuum of care during patient transfer from prehospital to ED management of the chest pain patient.
- All ECGs and list of medications administered pre-hospitally must accompany the patient to the ED.
- The PCR is to be left with the receiving staff before clearing after transfer of care unless there are exceptional circumstances. Information recorded in the PCR is very important for receiving hospital staff in real time.

CHARTING

In addition to the mandatory fields it is important to document the following in the ePCR text fields or complete the following processes:

- ✓ Any deviations from treatment modalities
- ✓ Patient's response to treatment
- ✓ Treatments rendered prior to EMS arrival
- ✓ The reperfusion checklist (if applicable)
- ✓ Attach all 12-lead ECGs to ePCR
- ✓ Time stamps such as time of symptom onset, as well as time of interventions
- ✓ Transmit all monitor data to appropriate electronic server

Key Points – Chest Pain

Maintain high index of suspicion for ACS

Consider serious non-ACS causes of chest pain

Early (and serial) ECG acquisition

Avoid narcotic use for ACS if possible

Avoid hyperoxia (goal is SpO_2 94-96%)

ECG changes may not be present in ACS patients

Pre-hospital clinicians are unable to rule out serious causes of chest pain

Expedite reperfusion for STEMI

Leave PCR at the receiving facility and transmit all data to the server

KNOWLEDGE GAPS

It is not always possible to update all local documents regarding acute coronary syndrome at the same rate at which international guidelines are changed. Please refer to current AHA guidelines for the most up-to-date information on best practices.

There are ongoing discussions regarding the use of oxygen and opioids in ACS, as well as the most appropriate catchment area for PCI. There is also

debate regarding possible subgroups of STEMI patients who may benefit more from TNK as opposed to PPCI.

Remote ischemic conditioning (RIC) is a new and relatively simple intervention that is being studied in STEMI patients. It has been shown to be feasible in the prehospital setting, and current evidence is hypothesis generating suggesting possible benefit. Further study is required before this intervention becomes practice changing.

Ideally our knowledge will also evolve in terms of best practices for system-wide safe inter-facility transport of STEMI patients. There is good evidence to support a pharmacoinvasive (PI) strategy for STEMI patients outside of cath lab catchment areas (receiving fibrinolytic, followed by early transport for cardiac catheterization). What is the minimum safety requirement for crew configuration when transporting recently fibrinolyzed patients for cardiac catheterization as part of a PI approach to STEMI? Will a province-wide PI strategy for STEMI be feasible in Nova Scotia?

EDUCATION

Formal certification in ACLS will enable improved ACS care. Practitioners are encouraged to maintain ACLS certification. Ongoing practice in scenario management can improve the care that you provide to the ACS patient.

Continuous practice with rhythm and ECG interpretation is important in order to remain proficient.

It is important to be aware of provincial programs regarding STEMI management in order to provide the appropriate reperfusion strategy.

QUALITY IMPROVEMENT

STEMI is a time sensitive emergency therefore recording accurate time stamps on the ePCR is needed in order to review and improve door-to-needle and door-to-balloon times.

If ECG transmission issues occur for any reason, it is important to complete and send in an occurrence form so the concern can be tracked and managed appropriately. Only through proper tracking, can system changes be made.

REFERENCES

Emergency Health Services Nova Scotia
EHSNS protocols 6228/6229/6317/6318
www.gov.ns.ca/health/ehs/paramedics/EBP.asp

https://emspep.cdha.nshealth.ca/

Alberta Health Services, Provincial Medical Protocols, Suspected Acute Coronary Syndrome, STEMI-Reperfusion Strategy, December 1, 2010, protocols@ahsems.com

Part 9: Acute Coronary Syndromes: 2015 American heart Association Guidelines Update for Cardiovascular Resuscitation and Emergency Cardiovascular Care; *Circulation* 2015; 132:S483-S500

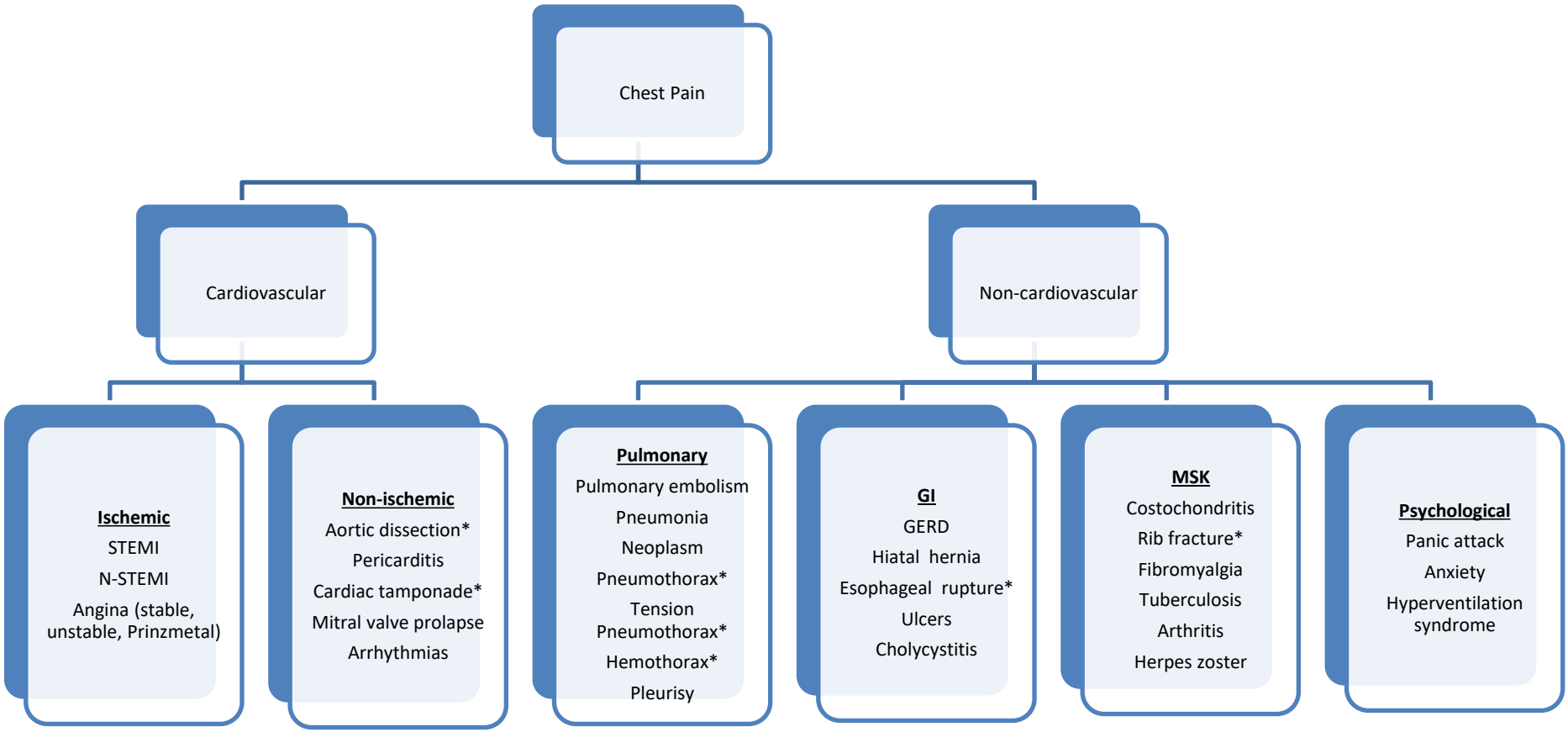

Figure 1: Differential diagnoses

*If the chest pain is of a suspected traumatic etiology, see the Torso Trauma Clinical Practice Guideline

Lead	P Wave	Q Wave	R Wave	S Wave	T Wave
I	Upright	Small	Largest of all leads	Small/none	Upright and less than 5 mm
II	Upright	None	Large	Small/none	Upright and less than 5 mm
III	Varies	Small/none	Varies	Varies	Varies
aVR	Inverted	Varies	Small/none	Large	Inverted
aVL	Varies	Varies	Varies	Varies	Varies
aVF	Upright	Small/none	Small/none	Varies	Varies
V1	Varies	QS complex	Small/none	Large	Varies
V2	Upright	None	Larger than V1	Large	Upright and less than 10 mm
V3	Upright	None	Varies	Varies	Upright and less than 10 mm
V4	Upright	None	Larger than V3	Smaller than V3	Upright and less than 10 mm
V5	Upright	Small	Larger than V4	Smaller than V4	Upright and less than 10 mm
V6	Upright	Small	Equal to or smaller than V5	Equal to or smaller than V5	Upright and less than 10 mm

Figure 2: Normal 12-Lead ECG Characteristics

STEMI location	Leads	Coronary Arteries Involved
Septal	≥2mm ST elevation in V1, V2	Left anterior descending
Anterior	≥2mm ST elevation in V3, V4	Left anterior descending
Inferior	≥1mm ST elevation in at least 2 leads of II, III, aVF or V4R	Right coronary artery, circumflex
Lateral	≥1mm ST elevation in at least 2 leads of I, aVL, V5, V6	Left anterior descending, circumflex
Posterior	≥1mm ST depression in V1-V2 and ≥1mm ST elevation in V8, V9	Right coronary artery, circumflex

Figure 3: STEMI Recognition Criteria

PEP 3x3 TABLES for CHEST PAIN

Throughout the EHS Guidelines, you will see notations after clinical interventions (e.g.: **PEP 2 neutral**). PEP stands for: the Canadian **P**rehospital **E**vidence-based **P**rotocols Project.

The number indicates the Strength of cumulative evidence for the intervention:
1 = strong evidence exists, usually from randomized controlled trials;
2 = fair evidence exists, usually from non-randomized studies with a comparison group; and
3 = weak evidence exists, usually from studies without a comparison group, or from simulation or animal studies.

The coloured word indicates the direction of the evidence for the intervention:
Green = the evidence is supportive for the use of the intervention; **Yellow = the evidence is neutral**; **Red = the evidence opposes** use of the intervention; **White** = there is no evidence available for the intervention, or located evidence is currently under review.

PEP Recommendations for Chest Pain Interventions, as of 2019/02/22. PEP is continuously updated. See: https://emspep.cdha.nshealth.ca/ for latest recommendations, and for individual appraised articles.

ACS/Suspected Cardiac Origin

Last Reviewed: Dec 12, 2017

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF EVIDENCE FOR INTERVENTION	1 (strong evidence exists)	• 12-Lead ECG • Anti-platelet (other) • ASA/Aspirin • Beta Blockers • Bypass/Direct to PCI • Drip and ship • Fibrinolysis • Nitrates • RIC (remote ischemic conditioning)	• GIK (Glucose-Insulin-Potassium) • Heparin • Lidocaine • Magnesium	• Oxygen-high flow • Oxygen-titrated	• Point of Care Troponin
	2 (fair evidence exists)	• Advanced Notice/Cath Lab Activation by EMS	• HEMS	• Morphine	
	3 (weak evidence exists)	• Ketamine • Nitrous Oxide • PAI-ASA			

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Chest Pain NYD

Last Reviewed: Dec 12, 2017

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF EVIDENCE FOR INTERVENTION	1 (strong evidence exists)				• Oxygen
	2 (fair evidence exists)				
	3 (weak evidence exists)				

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Program Document Number Management System

PDN: 6228.03	**Title:** Chest Pain	**Type:** CPG
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Effective Date: April 2 2013		Revision Date: June 27 2019
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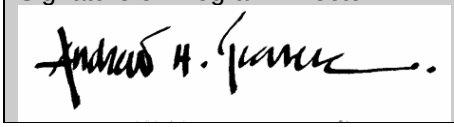
Signature of Program Director 		Signature of program Document Coordinator Tanya Fraser*** Electronically Signed

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Effective Date: April 2 2013		Revision Date: June 27 2019
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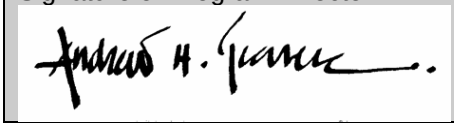
Signature of Program Director 		Signature of program Document Coordinator Tanya Fraser*** Electronically Signed

PDN: 6288.99.03.01	**Title:** STEMI Reperfusion Worksheet	**Type:** Field Guide
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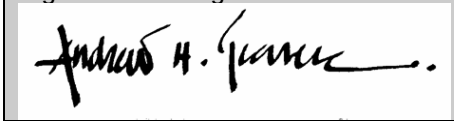
Signature of Program Director 		Signature of program Document Coordinator Tanya Fraser*** Electronically Signed

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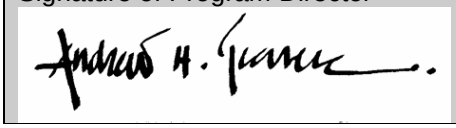
Signature of Program Director 	Signature of program Document Coordinator Tanya Fraser*** Electronically Signed

PDN: 6288.99.05.01	**Title:** Ischemic Chest Pain	**Type:** Field Guide
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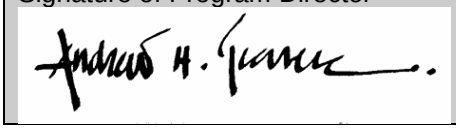
Signature of Program Director 	Signature of program Document Coordinator Tanya Fraser*** Electronically Signed	