



**G.H.A**



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## **G.H.A Pocket Guidelines**

Committee for practice Guidelines  
To improve the quality of clinical practice and  
patient care in GCC countries

**GUIDELINES ON MANAGEMENT  
OF ACUTE CORONARY SYNDROMES IN PATIENTS  
PRESENTING WITH PERSISTENT ST-SEGMENT ELEVATION**



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## ♥ Introduction

Acute Coronary Syndromes comprise a spectrum of increasingly severe ischemic conditions, including unstable angina, non ST-elevation myocardial infarction (NSTEMI) and ST-elevation myocardial infarction (STEMI).

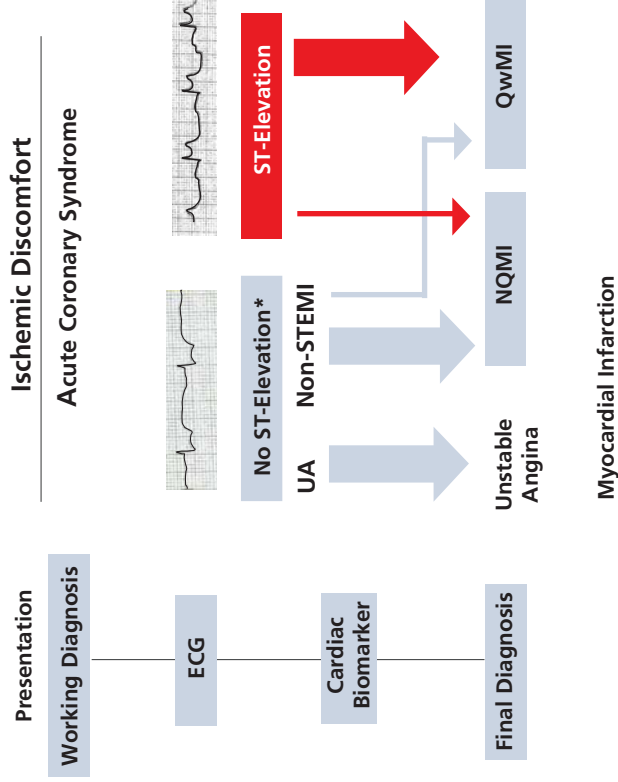
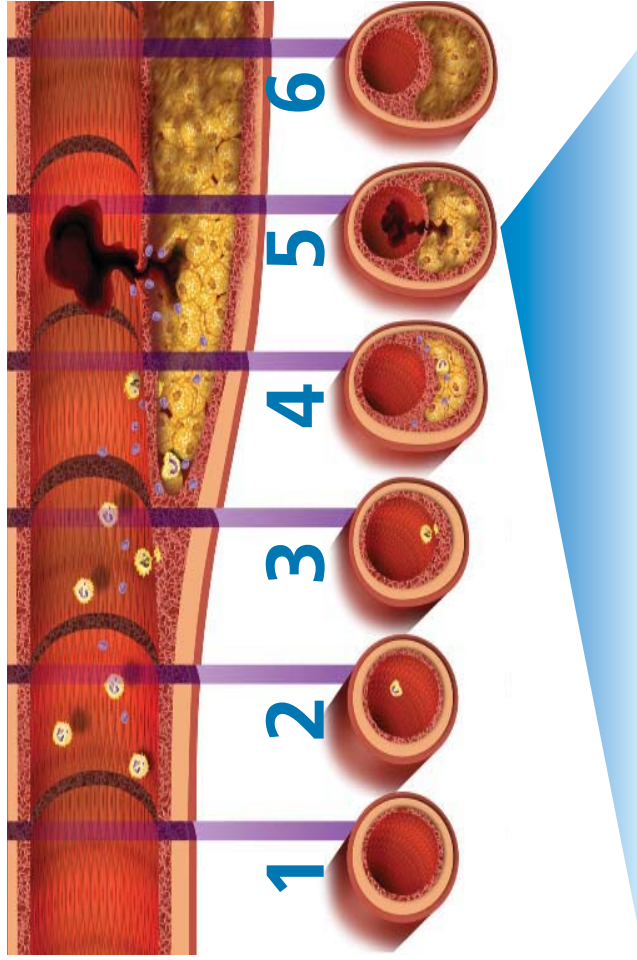
In the Gulf, STEMI represents 49% of Acute Coronary Syndromes. The majority of patients are males (85%), who on average are younger than females (58 years vs 62 years). According to the current practice, 75% of the patients receive thrombolytic therapy, while primary PTCA is performed in 5% of patients only. 54% of these patients are diabetics; 38% are hypertensives; 25% are smokers and 30% have hyperlipidemia.

Over the past few years, considerable improvement has occurred in the care for patients with STEMI. Newer and more sensitive and specific biochemical markers for the diagnosis of AMI were introduced which promoted the American College of Cardiology, American Heart Association and the European Society of Cardiology to redefine MI in 2002. Furthermore, newer therapeutic modalities including newer fibrinolytic, antithrombotic and antiplatelet agents were introduced. The Gulf Heart Association has recently published guidelines for the management of patients with acute coronary syndrome without STEMI elevation; Here in the GHA working group for the study of STEMI publishes guidelines for the management of STEMI adopted from the recently updated ACC/AHA guidelines, modified on the basis of more recent data and tailored to the need of our patients.

These guidelines refer to the management of patients with STEMI. The guidelines should be used as "Guidelines", which will apply to the majority of cases.

However it should be appreciated, that specific findings in individual patients may and should result in deviation from the proposed strategy. For every patient, the physician should make an individual decision taking into account the patient's history, presentation, findings during observation or investigation in hospital, and the available treatment facilities.

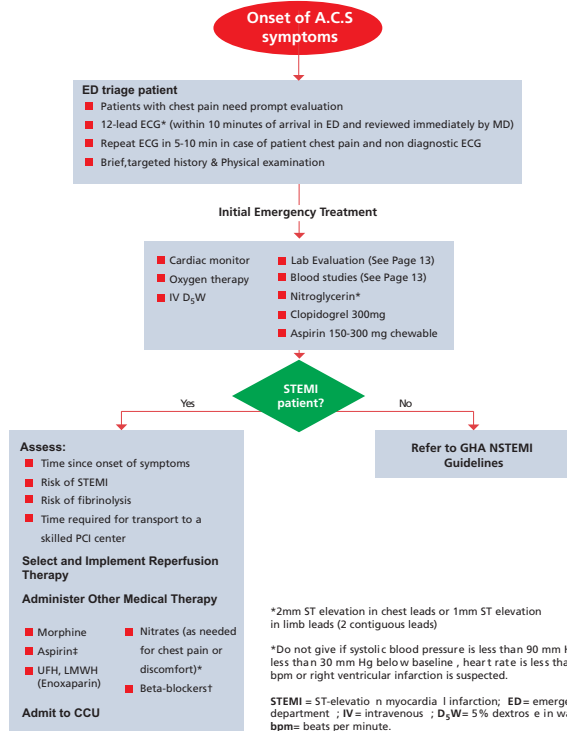
♥ *Figure 1. Acute Coronary Syndromes*





## Initial Recognition and Management in the Emergency Department

Emergency Department Algorithm/ For Patients With ACS/For Patients With Symptoms and Signs of STEMI



## Brief Physical Examination in the Emergency Department

1. Airway, Breathing, Circulation (ABC)
2. Vital signs, general observation
3. Presence or absence of jugular venous distension
4. Pulmonary auscultation for rales
5. Cardiac auscultation for murmurs and gallops
6. Presence or absence of stroke
7. Presence or absence of pulses
8. Presence or absence of systemic hypoperfusion (cool, clammy, pale, ashen)

## Differential Diagnosis of STEMI

<b>Life-threatening</b>	Aortic dissection	Tension pneumothorax
	Pulmonary embolus	Boerhaave syndrome (esophageal rupture with mediastinitis)
<b>Other cardiovascular and non-ischemic</b>	Pericarditis	LV hypertrophy with strain
	Atypical angina	Brugada syndrome
	Early repolarization	Myocarditis
	Wolff-Parkinson-White syndrome	Hyperkalemia
	Deeply inverted T-waves suggestive of a central nervous system lesion or apical hypertrophic cardiomyopathy	Bundle-branch blocks
		Vasospastic angina
		Hypertrophic cardiomyopathy
<b>Other noncardiac</b>	Gastroesophageal reflux (GERD) and spasm	Biliary or pancreatic pain
	Chest-wall pain	Cervical disc or neuropathic pain
	Pleurisy	Somatization and psychogenic pain disorder
	Peptic ulcer disease	
	Panic attack	

STEMI = ST-elevation myocardial infarction; LV = left ventricular.

**Step 1: Assess Time and Risk**

- Time since onset of symptoms
- Risk of STEMI
- Risk of fibrinolysis
- Time required for transport to a skilled PCI laboratory

**Step 2: Determine Whether Fibrinolysis or an Invasive Strategy Is Preferred**

*If presentation is less than 3 hours and there is no delay to an invasive strategy, there is no preference for either strategy*

**Fibrinolysis is generally preferred if:**

- **Early presentation** (less than or equal to 3 hours from symptom onset) and delay to invasive strategy.
- **Invasive strategy is not an option**
  - Catheterization laboratory occupied/not available
  - Vascular access difficulties
  - Lack of access to a skilled PCI laboratory†‡
- **Delay to invasive strategy**
  - Prolonged transport
  - Medical contact-to-balloon or door-to-balloon time is more than 90 minutes

**An invasive strategy is generally preferred if:**

- **Skilled PCI laboratory†‡ available with surgical backup**
  - Medical contact-to-balloon or door-to-balloon is less than 90 minutes
- **High risk from STEMI**
  - Cardiogenic shock
  - Killip class is greater than or equal to 3
- **Contraindications to fibrinolysis, including increased risk of bleeding and intracranial hemorrhage**
- **Late Presentation**
  - The symptom onset was more than 3 hours ago

STEMI= ST-elevation myocardial infarction;PCI= percutaneous coronary intervention.

**Absolute Contraindication**

- Any prior intracranial hemorrhage
- Known structural cerebral vascular lesion (e.g.,arteriovenous malformation)
- Known malignant intracranial neoplasm (primary or metastatic)
- Ischemic stroke within 3 months EXCEPT acute ischemic stroke within 3 hours
- Suspected aortic dissection
- Active bleeding or bleeding diathesis (excluding menses)
- Significant closed-head or facial trauma within 3 months

**Relative Contraindications**

- History of chronic,severe,poorly controlled hypertension
- Severe uncontrolled hypertension on presentation (SBP greater than 180 mm Hg or DBP greater than 110 mm Hg)†
- History of prior ischemic stroke greater than 3 months, dementia,or known intracranial pathology not covered in contraindications
- Traumatic or prolonged (greater than 10 minutes) CPR or major surgery (within less than 3 weeks)
- Recent (within 2 to 4 weeks) internal bleeding
- Non-compressible vascular punctures
- For streptokinase/ anistreplase:prior exposure (more than 5 days ago) or prior allergic reaction to these agents
- Pregnancy
- Active peptic ulcer
- Current use of anticoagulants: the higher the INR, the higher the risk of bleeding

STEMI= ST-elevation myocardial infarction; SBP= systolic blood pressure; DBP= diastolic blood pressure; INR= international normalized ratio.

\*Viewed as advisory for clinical decision making and may not be all-inclusive or definitive.

†Could be an absolute contraindication in low-risk patients with STEMI.



## ♥ Pharmacological Support During Primary PCI

Unfractionated Heparin	No GP IIb/IIIa Inhibitor	GP IIb/IIIa Inhibitor Used
Bolus:	70-100 U/kg	50-70 U/kg
Target ACT:	HemoTec:250-300 s Hemochron:300-350 s	With either device:200 s

- Thienopyridine**
- Administer loading dose of 300 mg - 600 mg (if not already given)
- Clopidogrel**
- Maintenance dose: 75 mg orally per day
  - Duration:
    - Bare metal stent—1 month minimum
    - Drug-eluting stent—minimum of 3 months after sirolimus and 6 months after paclitaxel
 Continue for 12 months after stent implantation (both types of stents) in patients who are not at risk of bleeding.

- GP IIb/IIIa Inhibitors**
- It is reasonable to start abciximab as early as possible before primary PCI (with or without stenting). The recommended dosage of abciximab in adults is a 0.25 mg/kg intravenous bolus administered 10 to 60 minutes before the start of PCI, followed by a continuous intravenous infusion of 0.125 mcg/kg/min (to a maximum of 10 mcg/min) for 12 to 18 hours.
  - Treatment with tirofiban (bolus dose of 10 mcg per kilogram of body weight, followed by an infusion of 0.15 mcg/kg/min for 18 to 24 hours) or eptifibatid (for patients with serum creatinine less than 2.0 mg/dL,\* an intravenous bolus of 180 mcg/kg administered immediately before the initiation of PCI followed by a continuous infusion of 2.0 mcg/kg/min and a second 180 mcg/kg bolus 10 minutes after the first bolus. Infusion should be continued 18 to 24 hours.

\*For patients with a serum creatinine greater than 2.0 mg/dL, an intravenous bolus of 180 mcg/kg administered immediately before initiation of the procedure, immediately followed by a continuous infusion of 1.0 mcg/kg/min and a second 180 mcg/kg bolus administered 10 minutes after the first.

GP=glycoprotein;ACT=a activated clotting time;U=units;s=seconds.

## ♥ Laboratory Evaluations for Management of STEMI

*Serum biomarkers for cardiac damage  
(do not wait for results before implementing reperfusion strategy)*

Complete blood count with platelet count

INR (international normalized ratio)

Activated partial thromboplastin time

Electrolytes and magnesium

BUN (blood urea nitrogen)

Creatinine

Glucose

Serum lipids

### Biochemical Markers

Marker	Point-of-Care Test Available	Advantages	Disadvantages
Cardiac troponins	Yes	<ol style="list-style-type: none"> <li>Greater sensitivity and specificity than CK-MB</li> <li>Detection of recent MI up to 2 weeks after onset</li> </ol>	<ol style="list-style-type: none"> <li>Low sensitivity in very early phase of MI (&lt;6 h after symptom onset)</li> <li>Limited ability to detect late minor reinfarction.</li> </ol>
CK-MB	Yes	<ol style="list-style-type: none"> <li>Rapid, cost-efficient, accurate assays</li> <li>Ability to detect early reinfarction</li> </ol>	<ol style="list-style-type: none"> <li>Loss of specificity in setting of skeletal muscle disease or injury, including surgery</li> <li>Low sensitivity during very early MI (&lt;6 h after symptom onset) or later after symptom onset (&lt;36 h) and for minor myocardial damage (detectable by troponins)</li> </ol>
Myoglobin	Yes	<ol style="list-style-type: none"> <li>High sensitivity</li> <li>Useful in early detection of MI</li> <li>Detection of reperfusion</li> <li>Most useful in ruling out MI</li> </ol>	<ol style="list-style-type: none"> <li>Very low specificity in setting of skeletal muscle injury or disease</li> <li>Rapid return to normal range limits sensitivity for later presentations</li> </ol>



## ♥ Acute CCU Management

### Sample Admitting Orders for Patients With STEMI

- 1. IV:NS on D<sub>5</sub>W** to keep vein open. Start a second IV if IV medication is being given. This may be a saline lock.
- 2. Vital signs:** Every 1.5 hours until stable, then every 4 hours and as needed. Notify physician if HR is less than 60 bpm or greater than 100 bpm, BP is less than 100 mm Hg systolic or greater than 150 mm Hg diastolic, respiratory rate is less than 8 or greater than 22 bpm.
- 3. Monitor:** Continuous ECG monitoring for arrhythmia and ST-segment deviation.
- 4. Diet:** NPO except for sips of water until stable. Then start diet with 2 g of sodium per day, low saturated fat (less than 7% of total calories/day), low cholesterol (less than 200 mg/day), such as Total Lifestyle Change (TLC) diet.
- 5. Activity:** Bedside commode and light activity when stable.
- 6. Oxygen:** Continuous oximetry monitoring. Nasal cannula at 2 L/min when stable for 6 hours, reassess for oxygen need (i.e., O<sub>2</sub> saturation less than 90%), and consider discontinuing oxygen.
- 7. Medications:**
  - a. Nitroglycerin**
    1. Use sublingual NTG 0.4 mg every 5 minutes as needed for chest pain or discomfort.
    2. Intravenous NTG for CHF, hypertension, or persistent ischemia that responds to nitrate therapy.
  - b. Aspirin**
    1. If aspirin not given in the ED, give chewable non-enteric-coated aspirin<sup>†</sup> 150 mg to 300mg
    2. If aspirin has been given, start daily maintenance of 75 to 150 mg. May use enteric-coated aspirin for gastro-intestinal protection.

### C. Clopidogrel

Maintain Clopidogrel 75 mg daily (For patients with PCI: Refer to PCI section)

### d. Oral Beta-Blocker

1. If not given in the ED, assess for contraindications, i.e., bradycardia and hypotension. Continue daily assessment to ascertain eligibility for beta-blocker.
2. If given in the ED, continue daily dose and optimize as dictated by HR and BP.

### e. ACE Inhibitor

Consider oral ACE inhibitor for all patients specially those with anterior infarction, pulmonary congestion, or LVEF less than 40% if the following are absent: hypotension (SBP less than 100 mm Hg or less than 30 mm Hg below baseline) or known contraindications to this class of medications.

### f. Angiotensin Receptor Blocker

Start ARB orally in patients who are intolerant of ACE inhibitors and who have either clinical or radiological signs of heart failure or LVEF less than 0.40.

### g. Pain Medications

IV morphine sulfate 2 to 4 mg with increments of 2 to 8 mg IV at 5- to 15-minute intervals as needed to control pain.

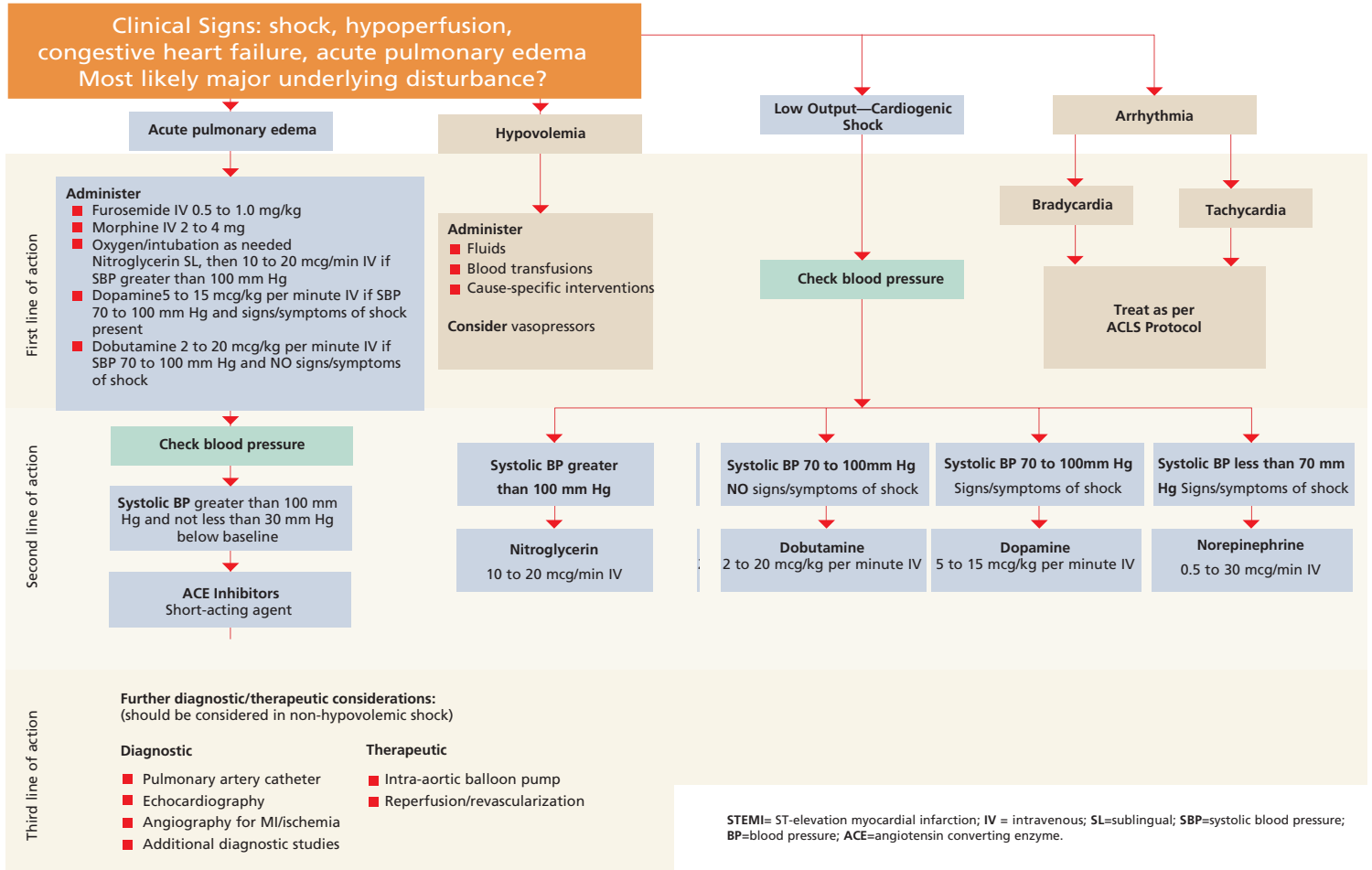
### h. Anxiolytics (based on a nursing assessment)

### i. Daily Stool Softener

#### Appendix

STEMI= ST-elevation myocardial infarction; IV= intravenous; NS= normal saline; D<sub>5</sub>W= 5% dextrose in water; HR= heart rate; BP= blood pressure; NPO= nothing by mouth; NTG= nitroglycerin; CHF= congestive heart failure; ED= emergency department; ACE= angiotensin converting enzyme; LVEF= left ventricular ejection fraction; SBP= systolic blood pressure; ARB= angiotensin receptor blocker; CBC= complete blood count; INR= international normalized ratio; aPTT= activated partial thromboplastin time; BUN= blood urea nitrogen.

# Emergency Management of Complicated STEMI



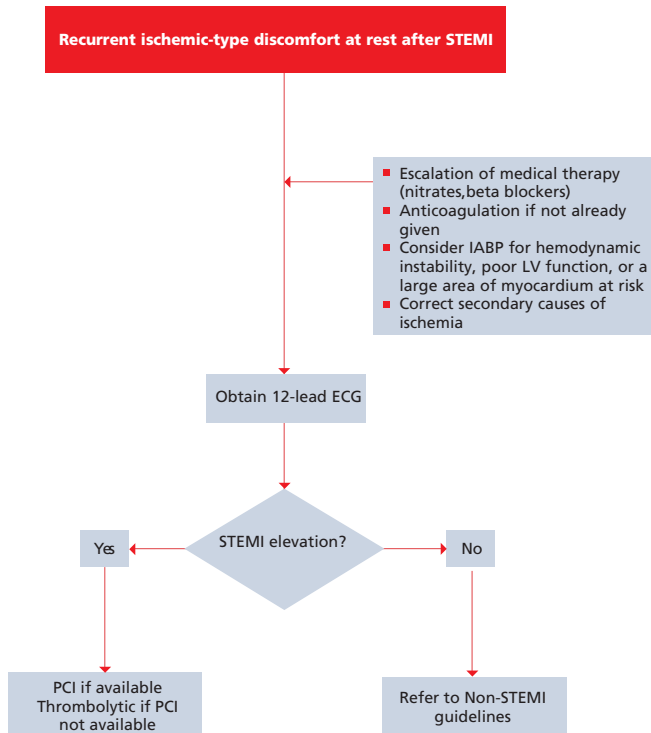
♥ *Characteristics of Ventricular Septal Rupture, Rupture of the Ventricular Free Wall, and Papillary Muscle Rupture*

Characteristic	Ventricular Septal Rupture	Rupture of Ventricular Free Wall	Papillary Muscle Rupture
<b>Incidence</b>	1-3% without reperfusion therapy, 0.2-0.34% with fibrinolytic therapy, 3.9% among patients with cardiogenic shock	0.8-6.2%, Fibrinolytic therapy does not reduce risk; primary PTCA seems to reduce risk	About 1% (posteromedial more frequent than anterolateral papillary muscle)
<b>Time course</b>	Bimodal peak; within 24 hours and 3-5 days; range 1-14 days	Bimodal peak; within 24 hours and 3-5 days; range 1-14 days	Bimodal peak; within 24 hours and 3-5 days; range 1-14 days
<b>Clinical manifestations</b>	Chest pain, shortness of breath, hypotension	Anginal, pleuritic, or pericardial chest pain, syncope, hypotension, arrhythmia, nausea, restlessness, hypotension, sudden death	Abrupt onset of shortness of breath and pulmonary edema; hypotension
<b>Physical findings</b>	Harsh holosystolic murmur, thrill (+), S <sub>3</sub> , accentuated 2nd heart sound, pulmonary edema, RV and LV failure, cardiogenic shock	Jugulovenous distention (29% of patients), pulsus paradoxus (47%), electromechanical dissociation, cardiogenic shock	A soft murmur in some cases, no thrill, variable signs of RV overload, severe pulmonary edema, cardiogenic shock
<b>Echocardiographic findings</b>	Ventricular septal rupture, left-to-right shunt on color flow Doppler echocardiography through the ventricular septum, pattern of RV overload	Greater than 5 mm pericardial effusion not visualized in all cases, layered, high-acoustic echoes within the pericardium (blood clot), direct visualization of tear, signs of tamponade	Hypercontractile LV, torn papillary muscle or chordae tendineae, flail leaflet, severe MR on color flow Doppler echocardiography
<b>Right-heart catheterization</b>	Increase in oxygen saturation from the RA to RV, large V-waves	Ventriculography insensitive, classic signs of tamponade not always present (equalization of diastolic pressures among the cardiac chambers)	No increase in oxygen saturation from the RA to RV, large V-waves, * very high pulmonary-capillary wedge pressures

PTCA= percutaneous transluminal coronary angioplasty; RV= right ventricular/ventricle; LV= left ventricular; RA= right atrium.

\*Large V-waves are from the pulmonary capillary wedge pressure.

## ♥ Algorithm for Management of Recurrent Ischemia/Infarction After STEMI



IABP= intra-aortic balloon pump; LV= left ventricular;  
PCI= percutaneous coronary intervention.

## ♥ Secondary Prevention and Long-Term Management

### Secondary Prevention for Patients With STEMI

#### GOALS

Smoking	Complete cessation
Blood pressure control	Less than 140/90 mm-Hg or less than 130/80 mm-Hg if chronic kidney disease or diabetes
Lipid management	LDL-C substantially less than 100 mg/dL, TG less than 150 mg/dl  HDL-C greater than 40 mg/dl in men & 50 mg/dl in women
Physical activity	30 minutes 3 to 4 days per week; Optimal daily
Weight management	BMI 18.5-24.9kg/m2 Waist circumference: Women; less than 35 inches; Men; less than 40 inches
Diabetes management	HbA1c less than 7%

BMI= body mass index; HDL-C= high-density lipoprotein cholesterol; LDL-C= low-density lipoprotein cholesterol; TG= triglycerides.



## Drugs Commonly Used in the Management of Patients With STEMI

Drug	First 24 Hours	During Hospitalization	At Discharge and Long-Term Follow-Up
Aspirin	Chewed (non-enteric-coated) in the emergency department (150 to 300 mg)	75 to 150 mg daily	75 to 150 mg per day indefinitely
Clopidogrel	300 mg loading dose	75 mg until discharge	<p>* If PCI patients, 75 mg Duration:</p> <p>i) Bare metal stent—1 month minimum</p> <p>ii) Drug-eluting stent—minimum of 3 months after sirolimus and 6 months after paclitaxel</p> <p>Continue up to 12 months after stent implantation (both types of stents) in patients who are not at risk of bleeding.</p> <p>*If allergy to Aspirin, 75 mg daily indefinitely</p>
Fibrinolytic Therapy† (See Contraindications /Cautions on Table 6)	<p>Alteplase, IV bolus 15 mg, infusion 0.75 mg/kg times 30 min (maximum 50 mg), then 0.5 mg/kg not to exceed 35 mg over the next 60 min to an overall maximum of 100 mg</p> <p>Retepase, 10 U IV over 2 min; 30 min after the first dose, give 10 U IV over 2 min</p> <p>Streptokinase, 1.5 MU IV over 30-60 min</p> <p>Tenecteplase, IV bolus over 10-15 seconds, 30 mg for weight less than 60 kg; 35 mg for 60-69 kg; 40 mg for 70-79 kg; 45 mg for 80-89 kg; 50 mg for 90 kg or more</p>		
Unfractionated Heparin	60 U/kg (max: 4000 U) as IV bolus, infusion 12 U/kg/hr (max: 1000 U/hr) to maintain aPTT at 1.5 to 2.0 times control (approximately 50 to 70 seconds)	Maintain aPTT at 1.5 to 2.0 times control (approximately 50 to 70 seconds) for at least 48 hours	Antithrombotic therapy recommendations
LMWH (Enoxaparin) for patients less than 70 years	30 mg bolus + 1 mg/kg twice daily	1 mg/kg twice daily	

Drug	First 24 Hours	During Hospitalization	At Discharge and Long-Term Follow-Up
Beta-Blockers*	Oral daily	Oral daily	Oral daily indefinitely
ACE Inhibitors	ACE inhibitor to all patients with anterior infarction, pulmonary congestion, or LVEF less than 0.40 in the absence of hypotension or known contraindications; titrate and adjust for blood pressure and creatinine	Oral daily	Oral daily indefinitely
Angiotensin Receptor Blockers (ARB)	An ARB should be administered to patients intolerant of ACE inhibitors and with either clinical/radiological signs of heart failure or LVEF less than 40%	Same as first 24 hours	Same as first 24 hours
Nitroglycerin	Sublingual NTG 0.4 mg every 5 min as needed for chest pain or discomfort	Oral for ongoing ischemia or uncontrolled hypertension	
Statins	Start without lipid profile	Same as first 24 hours	Indefinitely if LDL-C is 100 mg/dL or greater; titrate until LDL-C is substantially less than 100 mg/dL
Morphine Sulfate	Intravenous morphine sulfate 2 to 4 mg with increments of 2 to 8 mg IV at 5- to 15-min intervals as needed to control pain		

### References:

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- "Addition of Clopidogrel to Aspirin and Fibrinolytic Therapy for Myocardial Infarction with ST-Segment Elevation. The CLARITY TIMI-28 Investigators. N Engl J Med 2005;352."
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- "Efficacy and safety of tenecteplase in combination with enoxaparin, abciximab, or unfractionated heparin: the ASSENT-3 randomized trial in acute myocardial infarction. The Assessment of the Safety and Efficacy of a New Thrombolytic Regimen (ASSENT)-3 Investigators. THE LANCET • Vol 358:605-613 • August 25, 2001"