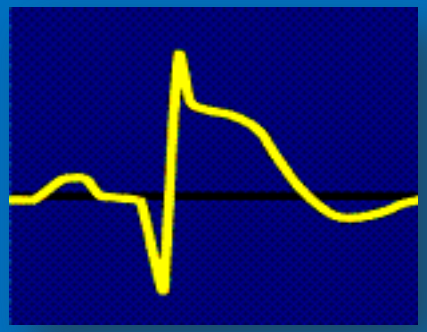
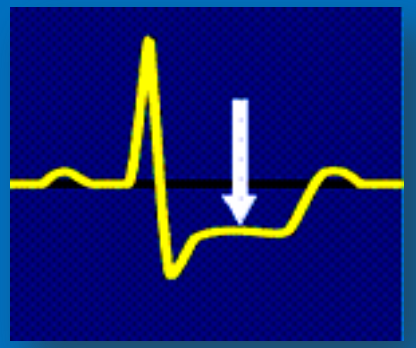


Acute Coronary syndrome 2013



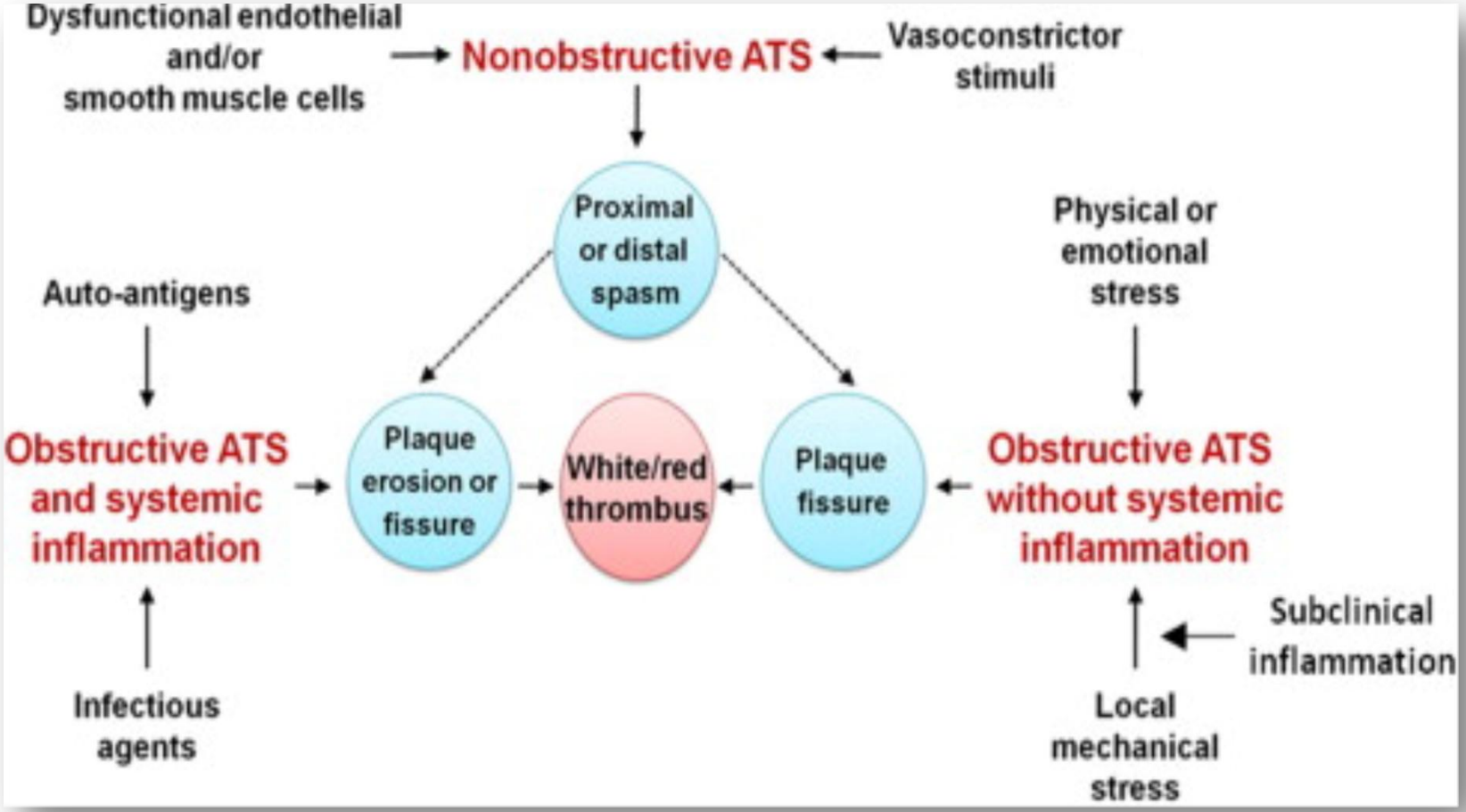
นายแพทย์เกรียงไกร เฮงรัศมี

หัวหน้ากลุ่มงานอายุรศาสตร์หัวใจ

สถาบันโรคทรวงอก

นนทบุรี

New Pathogenesis of ACS 2013

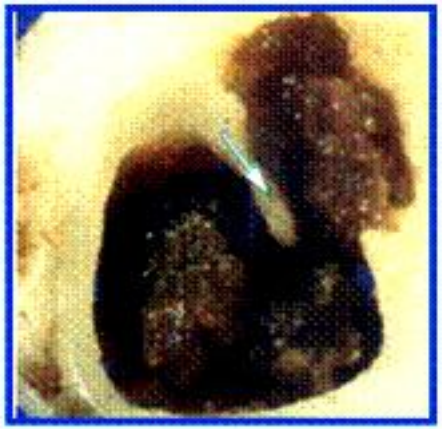


ACS 2013 -KK

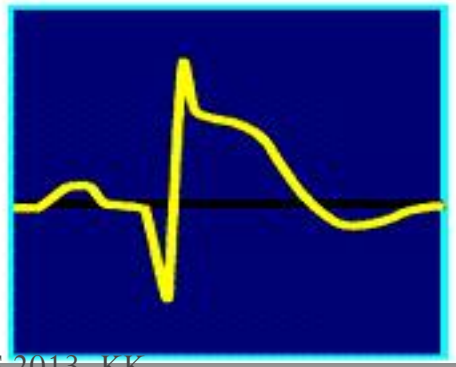
J Am Coll Cardiol. 2013;61(1):1-11. doi:10.1016/j.jacc.2012.07.064

Patho-physiology

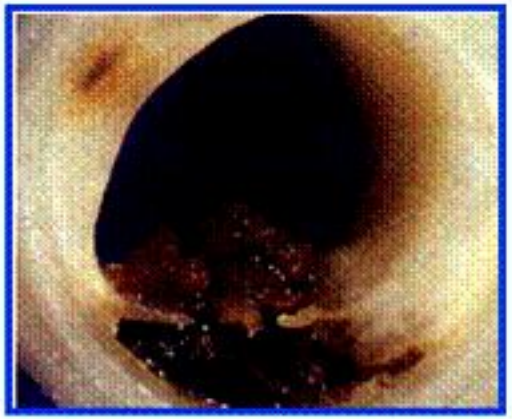
ACS with persistent ST-segment elevation



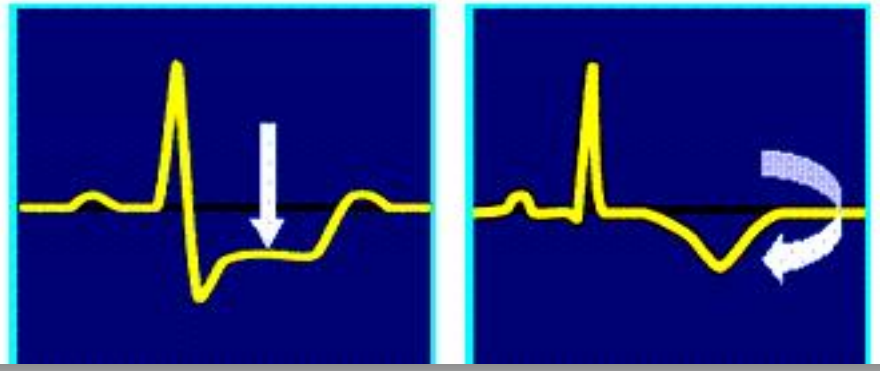
Adapted from Michael Davies



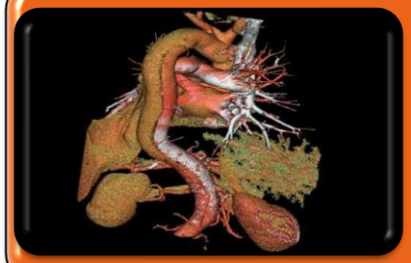
ACS without persistent ST-segment elevation



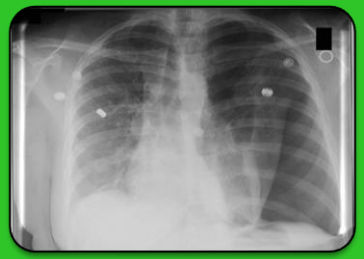
Adapted from Michael Davies



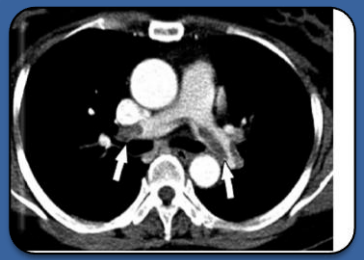
Differential Diagnosis



Aortic dissection

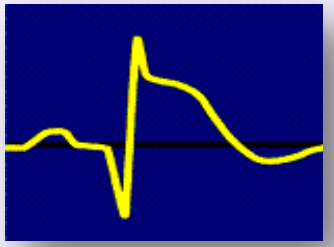


Pneumothorax



Pulmonary embolism

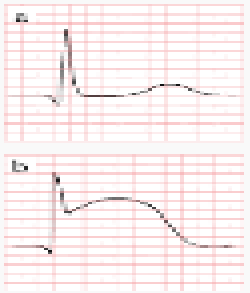
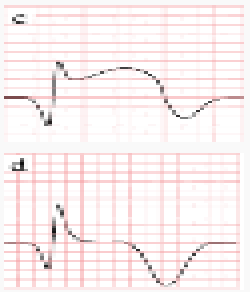
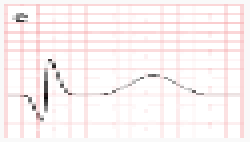
All of these complaints warrant a 12-lead ECG!



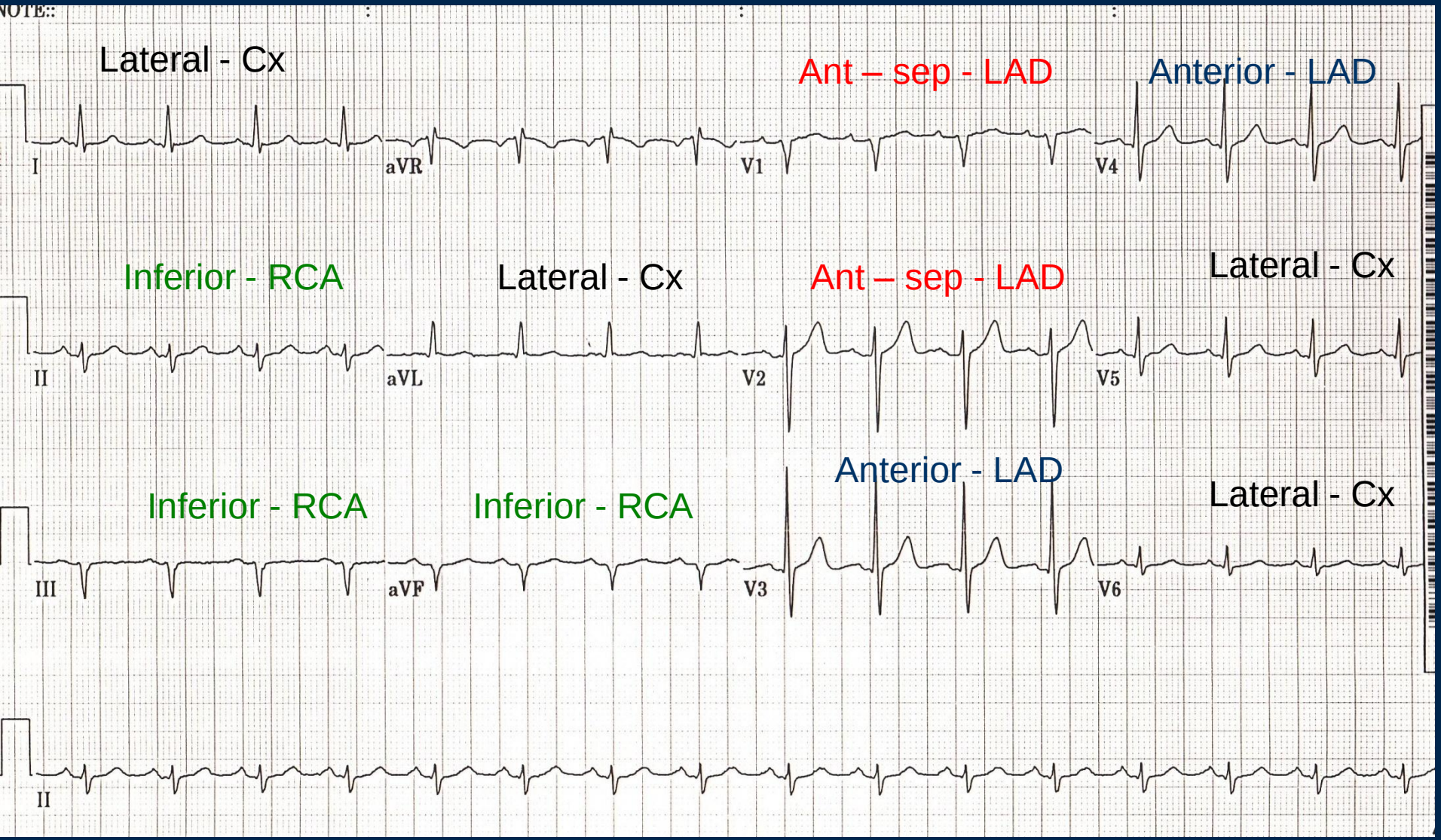
- Chest pain
- Atypical chest pain
- Epigastric pain
- Back, neck, jaw, or arm pain without chest pain
- Palpitations
- Syncope or near syncope
- Pulmonary edema
- Exertional dyspnea
- Weakness
- Diaphoresis unexplained by ambient temperature
- Feeling of anxiety or impending doom
- Suspected diabetic ketoacidosis

Evolution of EKG in STEMI

Evolution of the EKG during acute myocardial infarction

	Figure	change
minutes		hyperacute T waves (peaked T waves) ST-elevation
hours		ST-elevation, with terminal negative T wave negative T wave (these can last for months)
days		Pathologic Q Waves

ST Elevation Localizing Infarcts on the 12 Lead ECG



Posterior Myocardial Infarction

- **Clinical Significance**
- Posterior infarction accompanies 15-20% of STEMIs, usually occurring in the context of an inferior or lateral infarction.
- Isolated posterior MI is less common (3-11% of infarcts).
- Posterior extension of an inferior or lateral infarct implies a much larger area of myocardial damage, with an increased risk of left ventricular dysfunction and death.
- Isolated posterior infarction is an indication for emergent coronary reperfusion. However, the lack of obvious ST elevation in this condition means that the diagnosis is often missed.

The ACC/AHA 2013 guidelines makes these changes, which we've covered before, to the identification of STEMI:

- "New or presumed new" Left Bundle Branch Block is no longer an indication for a STEMI.
- **Providers should** use Sgarbossa's criteria to diagnose STEMI in the presence of LBBB. *(Editor's Note: we're going to go ahead and add that our readers should take this one step further and utilize Smith's modification to Sgarbossa's criteria.)*
- **Isolated ST-depression in V1-V4 is an indication of a posterior STEMI.**
- Widespread ST-depression with ST-elevation in aVR **is an indication of proximal LAD or LMCA occlusion.** *(Editor's Note: the evidence points more towards this being an indication of 3-vessel disease or near occlusion of the LAD/LMCA.)*
- Hyperacute T-waves**, e.g. de Winter ST/T-wave changes, are an early indicator of a STEMI.**

UA/NSTEMI
9/00

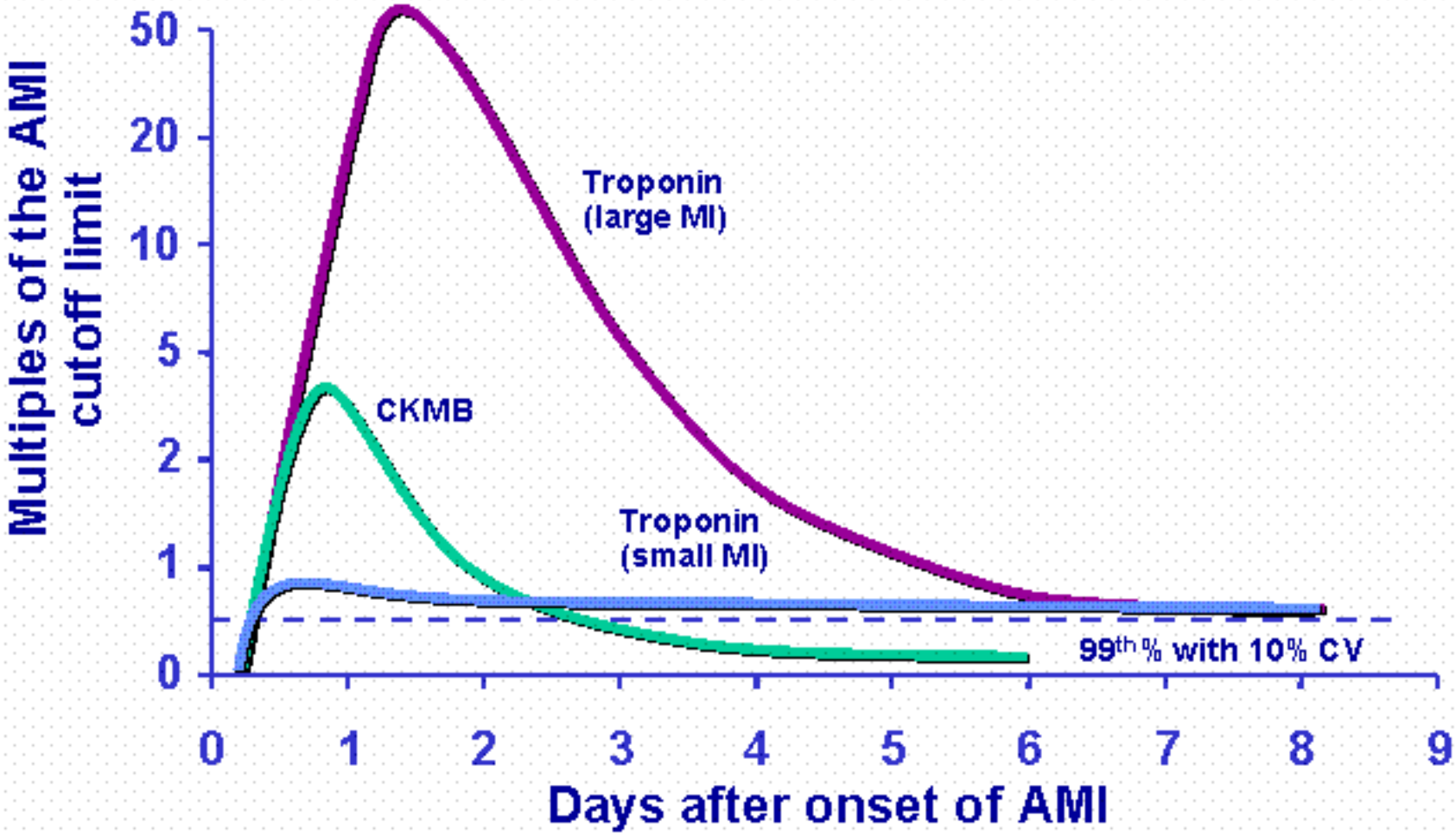
UA/NSTEMI
THREE PRINCIPAL PRESENTATIONS

Rest Angina*	**Angina occurring at rest and prolonged, usually > 20 minutes**
New-onset Angina	**New-onset angina of at least CCS Class III severity**
Increasing Angina	**Previously diagnosed angina that has become distinctly more frequent, longer in duration, or lower in threshold (i.e., increased by ≥ 1 CCS) class to at least CCS Class III severity.**

* Pts with NSTEMI usually present with angina at rest.

Braunwald
Circulation 80:410; 1989

Appearance of Biomarkers in Blood after Onset of Myocardial Infarction



Cardiac markers

- Troponin (T, I)
  - ***Very specific and more sensitive than CK***
  - ***Rises 4-8 hours after injury***
  - ***May remain elevated for up to two weeks***
  - Can provide prognostic information
  - Troponin T may be elevated with renal dz, poly/dermatomyositis

- CK-MB isoenzyme
  - *Rises 4-6 hours after injury and peaks at 24 hours*
  - *Remains elevated 36-48 hours*
  - Positive if CK/MB > 5% of total CK and 2 times normal
  - Elevation can be predictive of mortality
  - False positives with exercise, trauma, muscle dz, DM, PE

Elevations of Troponin in the absence of an Acute Coronary Syndrome

- Congestive heart failure - acute and chronic
- Renal Failure
- Tachy or bradyarrhythmias, or heart block
- Acute neurological disease, including stroke, or subarachnoid haemorrhage
- Pulmonary embolism, severe pulmonary hypertension
- Cardiac contusion, ablation, pacing, cardioversion, or endomyocardial biopsy
- Infiltrative diseases, e.g., amyloidosis, haemochromatosis, sarcoidosis, and scleroderma

White HD Lancet 2008

Elevations of Troponin in the absence of an Acute Coronary Syndrome

- Inflammatory diseases, e.g., myocarditis, myocardial extension of endocarditis
- Drug toxicity, e.g., adriamycin, 5-fluorouracil, herceptin, capecitabine
- Aortic dissection, aortic valve disease, hypertrophic cardiomyopathy
- Hypothyroidism
- Phaeochromocytoma
- Takosubo cardiomyopathy
- Burns affecting >30% of body surface area
- Rhabdomyolysis with cardiac injury
- Critically ill patients with respiratory failure, or sepsis
- Snake bites

White HD Lancet 2008

Management of ACS

Time is muscle

Muscle = Survival

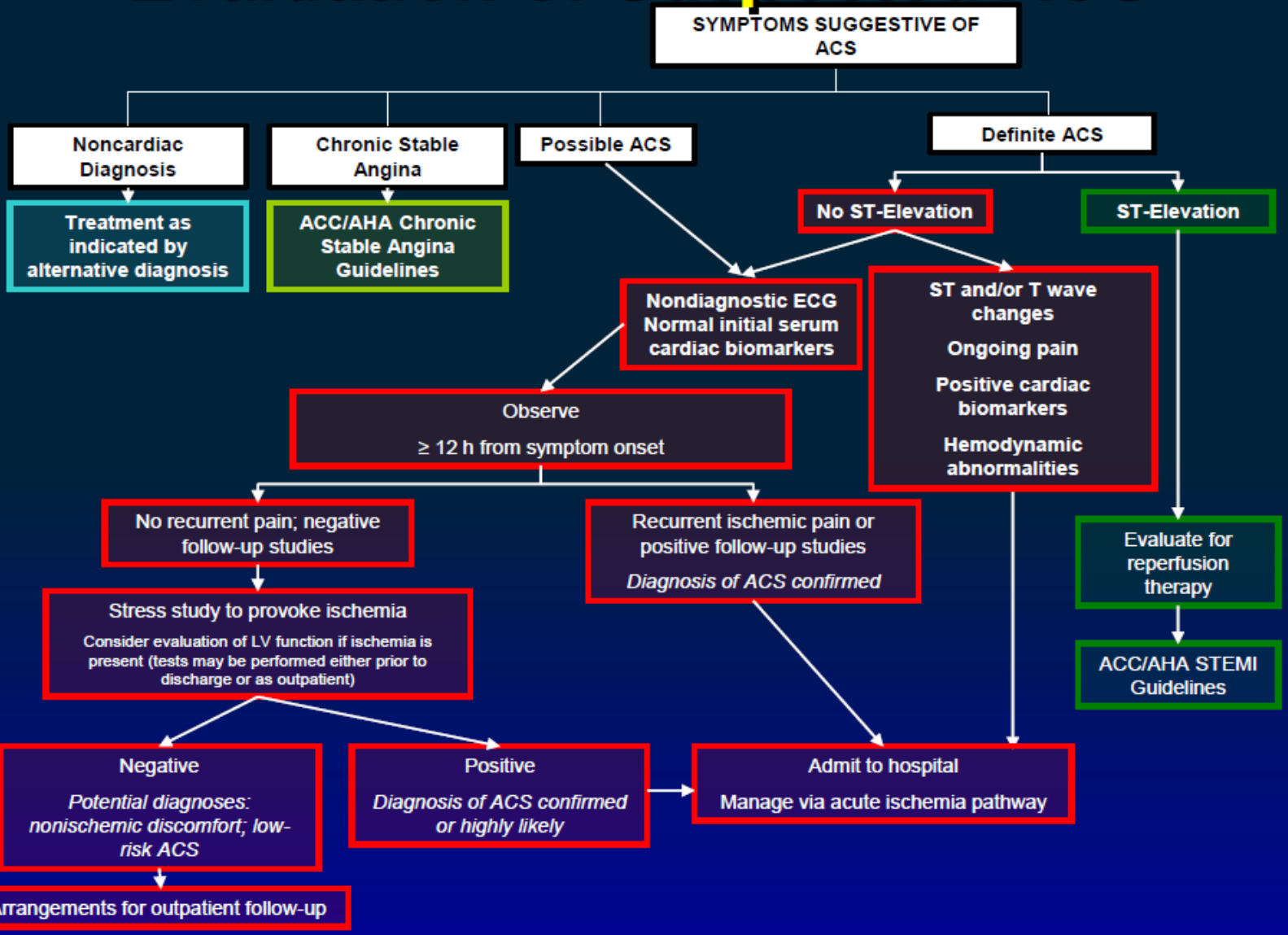
Aims:

- **to prevent death**
- **to minimize patient's discomfort and distress**
- **to limit the extent of myocardial damage**

Strategy:

- **Re-establish myocardial reperfusion before irreversible damage occurs:**
  - ***mechanically (Percutaneus coronary intervention)***
  - ***pharmacologically (induction of thrombolysis by fibrinolytic agent)***

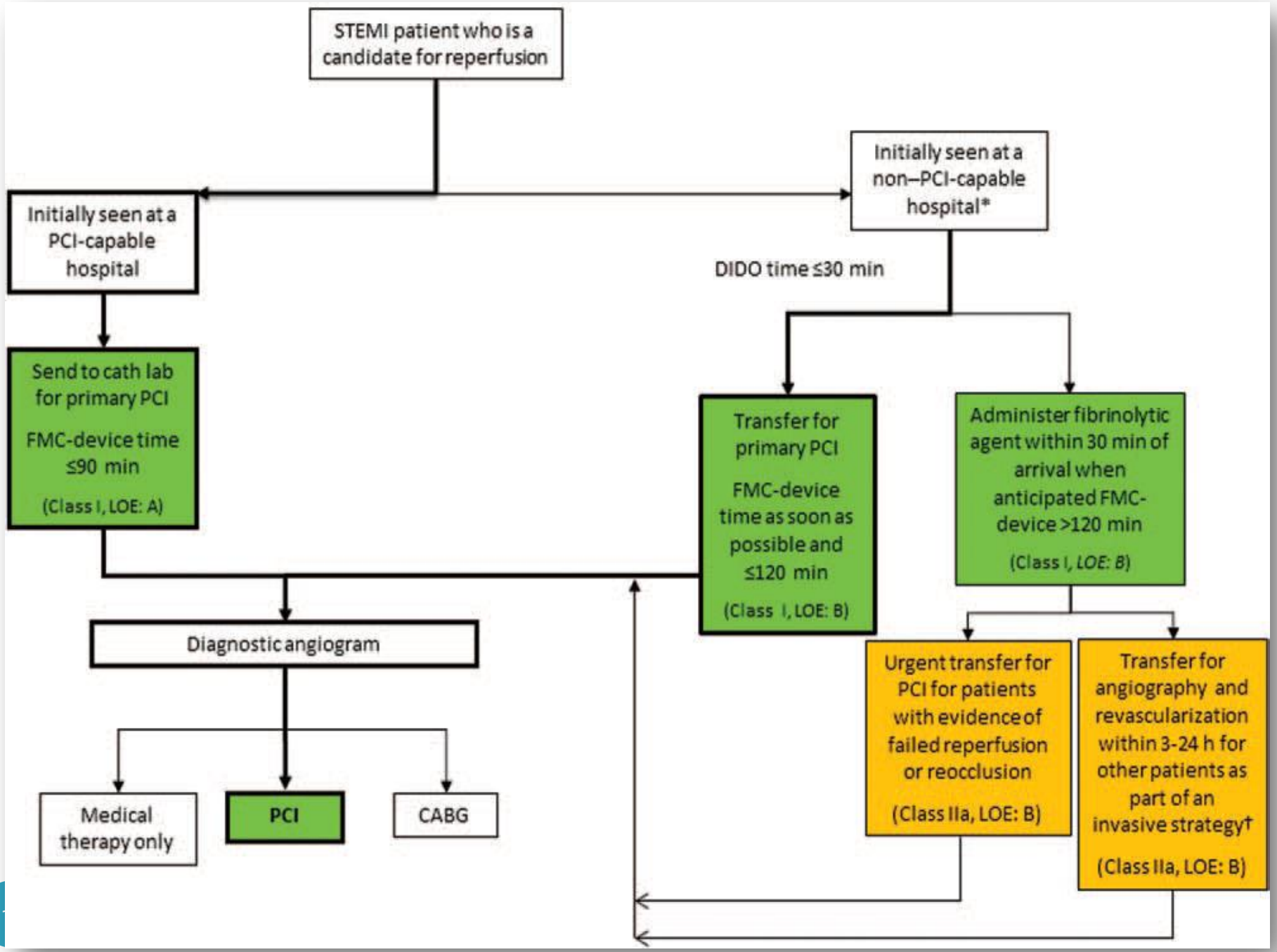
Evaluation of Suspected ACS



Anderson JL, et al. J Am Coll Cardiol 2007;50:e1–e157

Med.Management for STEMI

- Morphine to relief pain
- Oxygen if oxygen saturation < 94%
- NTG or ISDN to relief pain (no history of sildenafril within 24 hours)
- Antiplatelets
- Statin
- Beta blocker
- ACEI or ARB


STEMI patient who is a candidate for reperfusion
Initially seen at a PCI-capable hospital
Initially seen at a non–PCI-capable hospital*
DIDO time ≤30 min
Send to cath lab for primary PCI
FMC-device time ≤90 min
(Class I, LOE: A)
Transfer for primary PCI
FMC-device time as soon as possible and ≤120 min
(Class I, LOE: B)
Administer fibrinolytic agent within 30 min of arrival when anticipated FMC-device >120 min
(Class I, LOE: B)
Diagnostic angiogram
Urgent transfer for PCI for patients with evidence of failed reperfusion or reocclusion
(Class IIa, LOE: B)
Transfer for angiography and revascularization within 3-24 h for other patients as part of an invasive strategy†
(Class IIa, LOE: B)
Medical therapy only
PCI
CABG

Indications for Fibrinolytic Therapy When There Is a >120-Minute Delay From FMC to Primary PCI

	COR	LOE
Ischemic symptoms <12 h	I	A
Evidence of ongoing ischemia 12 to 24 h after symptom onset and a large area of myocardium at risk or hemodynamic instability	IIa	C
ST depression, except if true posterior (inferobasal) MI is suspected or when associated with ST elevation in lead aVR	III: Harm	B

Comparison of Approved Fibrinolytic Agents

(Antman EM et al: ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction. Circulation 110:e82, 2004.)

PARAMETER	STREPTOKINASE	ALTEPLASE	RETEPLASE	TNK t-PA
Dose	1.5 MU in 30-60 min	Up to 100 mg in 90 min (based on weight)	10 U ? 2 (30 min apart) each over 2 min	30-50 mg based on weight
Bolus administration	No	No	Yes	Yes
Antigenic	Yes	No	No	No
Allergic reactions hypotension most common	Yes	No	No	No
Systemic fibrinogen depletion	Marked	Mild	Moderate	Minimal
90-min patency rates (%)	≈50	≈75	≈75	≈75
TIMI grade 3 flow (%)	32	54	60	63
Cost per dose (Rs)	2500	39375 (50mg)		

Indications for Transfer for Angiography After Fibrinolytic Therapy

	COR	LOE
Immediate transfer for cardiogenic shock or severe acute HF irrespective of time delay from MI onset	I	B
Urgent transfer for failed reperfusion or reocclusion	IIa	B
As part of an invasive strategy in stable* patients with PCI between 3 and 24 h after successful fibrinolysis	IIa	B

*Although individual circumstances will vary, clinical stability is defined by the absence of low output, hypotension, persistent tachycardia, apparent shock, high-grade ventricular or symptomatic supraventricular tachyarrhythmias, and spontaneous recurrent ischemia.

Primary PCI in STEMI

	COR	LOE
Ischemic symptoms <12 h	I	A
Ischemic symptoms <12 h and contraindications to fibrinolytic therapy irrespective of time delay from FMC	I	B
Cardiogenic shock or acute severe HF irrespective of time delay from MI onset	I	B
Evidence of ongoing ischemia 12 to 24 h after symptom onset	IIa	B
PCI of a noninfarct artery at the time of primary PCI in patients without hemodynamic compromise	III: Harm	B

Adjunctive Antithrombotic Therapy to Support Reperfusion With Fibrinolytic Therapy

	COR	LOE
Antiplatelet therapy		
Aspirin		
• 162- to 325-mg loading dose	I	A
• 81- to 325-mg daily maintenance dose (indefinite)	I	A
• 81 mg daily is the preferred maintenance dose	IIa	B
$P2Y_{12}$ receptor inhibitors		
• Clopidogrel:	I	A
◦ Age ≤75 y: 300-mg loading dose		
▪ Followed by 75 mg daily for at least 14 d and up to 1 y in absence of bleeding	I	A (14 d)
		C (up to 1 y)
◦ Age >75 y: no loading dose, give 75 mg	I	A
▪ Followed by 75 mg daily for at least 14 d and up to 1 y in absence of bleeding	I	A (14 d)
		C (up to 1 y)

Adjunctive Antithrombotic Therapy to Support Reperfusion With Fibrinolytic Therapy (cont.)

	COR	LOE
Anticoagulant therapy		
• UFH:	I	C
◦ Weight-based IV bolus and infusion adjusted to obtain aPTT of 1.5 to 2.0 times control for 48 h or until revascularization. IV bolus of 60 U/kg (maximum 4000 U) followed by an infusion of 12 U/kg/h (maximum 1000 U) initially, adjusted to maintain aPTT at 1.5 to 2.0 times control (approximately 50 to 70 s) for 48 h or until revascularization		
• Enoxaparin:	I	A
◦ If age <75 y: 30-mg IV bolus, followed in 15 min by 1 mg/kg subcutaneously every 12 h (maximum 100 mg for the first 2 doses)		
◦ If age ≥75 y: no bolus, 0.75 mg/kg subcutaneously every 12 h (maximum 75 mg for the first 2 doses)		
◦ Regardless of age, if CrCl <30 mL/min: 1 mg/kg subcutaneously every 24 h		
◦ Duration: For the index hospitalization, up to 8 d or until revascularization		
• Fondaparinux:	I	B
◦ Initial dose 2.5 mg IV, then 2.5 mg subcutaneously daily starting the following day, for the index hospitalization up to 8 d or until revascularization		
◦ Contraindicated if CrCl <30 mL/min		

Performance Measures and Quality Metrics

Acute/In-hospital Measures (first 24 hours) (2006 Performance Measure)

- Aspirin
- STEMI - Any reperfusion (PCI or Lytic)
- STEMI- Lytic -Door to Needle (Median Time and % <30min)
- STEMI - PCI - Door to Balloon (Median Time and % <90min for non transfer)

Discharge Measures (among eligible) (2006 Performance Measure)

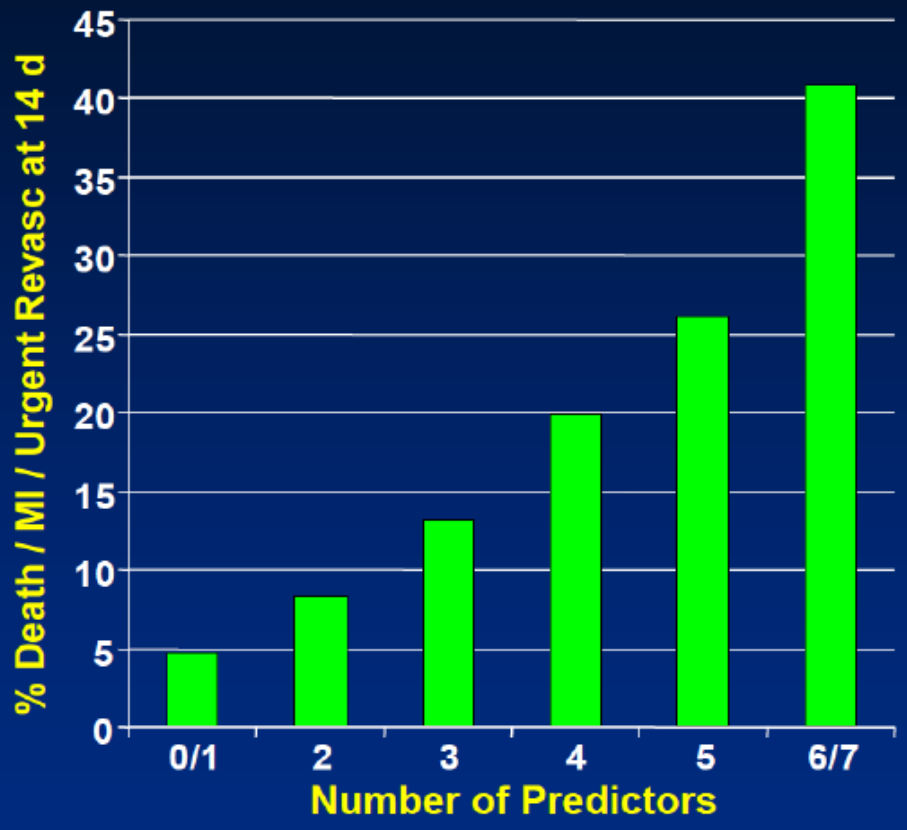
- Aspirin
- B-blocker
- ACE or ARB (EF <40%)
- Lipid lowering therapy if LDL ≥100mg/dL
- Smoking cessation (among smokers)

ACTION Metrics (New from 2007 Guidelines)

- Door to EKG (Median Time and % at goal <10 min)
- LDL assessment (in-hospital)
- Initial UFH Dosing (>60 U/kg bolus, >12 U/kg/min infusion, exclude cath lab initiation)
- Initial LMWH Dosing (10 mg over either 1mg/kg/24 hours if CrCl <30cc/min or >2mg/kg/24 hours)
- Initial GP IIb/IIIa Dosing (Tirofiban and Eptifibatide)
- NSTEMI Antiplatelet–clopidogrel or GP 2b3a inhibitor (first 24 hours)
- NSTEMI Antithrombin- either UFH, enoxaparin, bivalarudin or fondaparinux (first 24 hours)
- STEMI – Transfer PCI - Door to Balloon (Median Time and % <120min for transfer)
- Discharge ACE or ARB (EF <40%, HTN or DM), Statin, Clopidogrel
- Cardiac rehabilitation

TIMI Risk Score for UA/NSTEMI: 7 Independent Predictors

1. Age ≥65 y
2. ≥3 CAD risk factors (high cholesterol, family history, hypertension, diabetes, smoking)
3. Prior coronary stenosis ≥50%
4. Aspirin in last 7 days
5. ≥2 anginal events ≤24 h
6. ST-segment deviation
7. Elevated cardiac markers (CK-MB or troponin)



Antman EM, et al. JAMA 2000;284:835–42

Early Risk Stratification

GRACE Risk Score

Variable	Odds ratio
Older age	1.7 per 10 y
Killip class	2.0 per class
Systolic BP	1.4 per 20 mm Hg ↑
ST-segment deviation	2.4
Cardiac arrest during presentation	4.3
Serum creatinine level	1.2 per 1-mg/dL ↑
Positive initial cardiac biomarkers	1.6
Heart rate	1.3 per 30-beat/min ↑

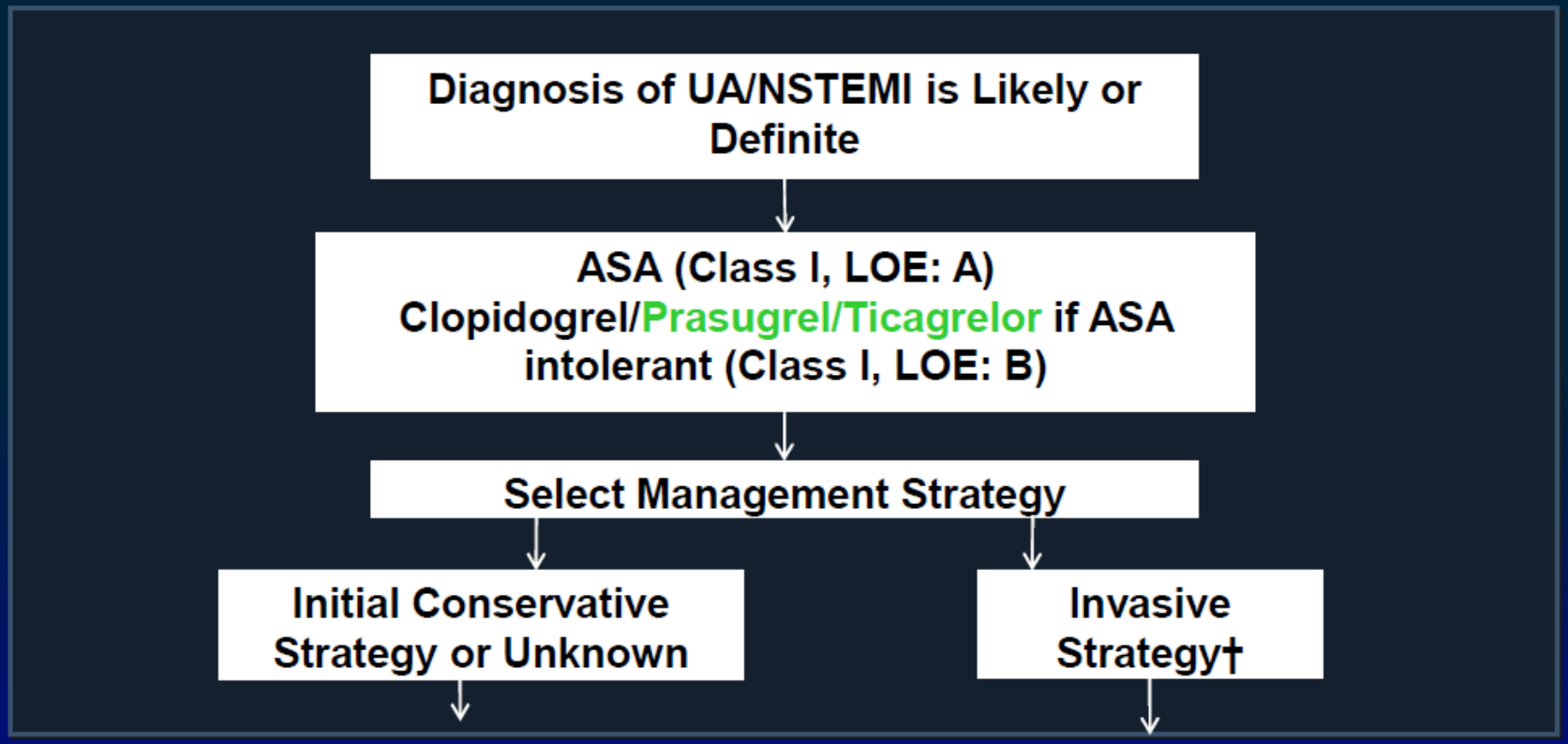
Eagle KA, et al. JAMA 2004;291:2727–33.

Treatment of Non-ST-Elevation ACS
Early Hospital Care

- **Activity- bed/chair rest with continuous EKG monitoring**
- **Supplemental oxygen (SaO2 <90%, respiratory distress)**
- **Anti-Ischemic Therapy**
  - Analgesic: NTG- sublingual/intravenous (I) or Morphine (IIa)
  - Beta-blocker
  - CCB
  - ACE/ARB- within first 24 hours

Jneid et al. J Am Coll Cardiol. 2012;60(7):645-681

Treatment of Non ST-Elevation ACS



Jneid et al. J Am Coll Cardiol. 2012;60(7):645-681

UA/NSTEMI
9/00

RISK STRATIFICATION IN EMERGENCY DEPARTMENT

HIGH RISK-FEATURES (RISK RISES WITH NUMBER)

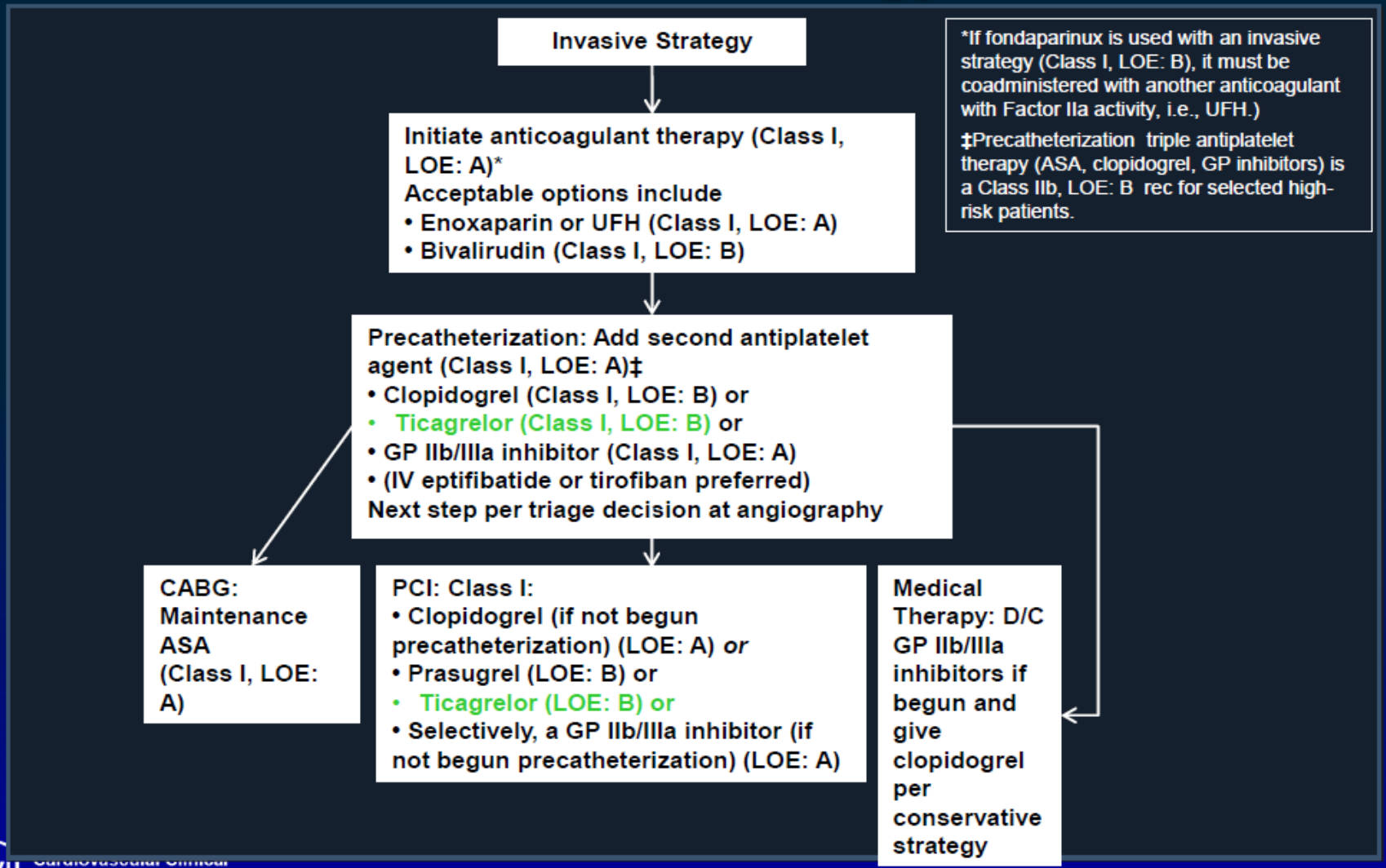
History	Prolonged ischemic discomfort (>20 min), ongoing
Clinical findings	rest pain, accelerating tempo of ischemia
	Pulmonary edema; S_3 or new rales
	New MR murmur
	Hypotension, bradycardia, tachycardia
	Age >75 years
ECG	Rest pain with transient ST-segment changes
	> 0.05 mV; new bundle-branch block, new sustained VT
Cardiac markers	Elevated (e.g. TnT or TnI>0.1 ng/mL)

High risk UA or NSTEMI-ACS

- Severe chest pain (prolong, ongoing, recurrent chest pain > 2 within 24 hours)
- Unstable hemodynamic (hypotension, new tachyarrhythmia,bradycardia , heart block),
- Cardiogenic shock
- Heart failure , LVEF < 40%
- New MR murmur
- Dynamic ischemic ST-T changes with chest pain, sustained ventricular tachycardia
- Elevated troponin T หรือ troponin I > 0.1 ng/ml
- อายุมากกว่า 75 ปี
- Prior PCI ภายใน 6 เดือน
- Prior CABG
- DM
- Mild to moderate renal dysfunction
- High risk score (Grace risk score > 140)

Treatment of Non ST-Elevation ACS

Invasive Strategy

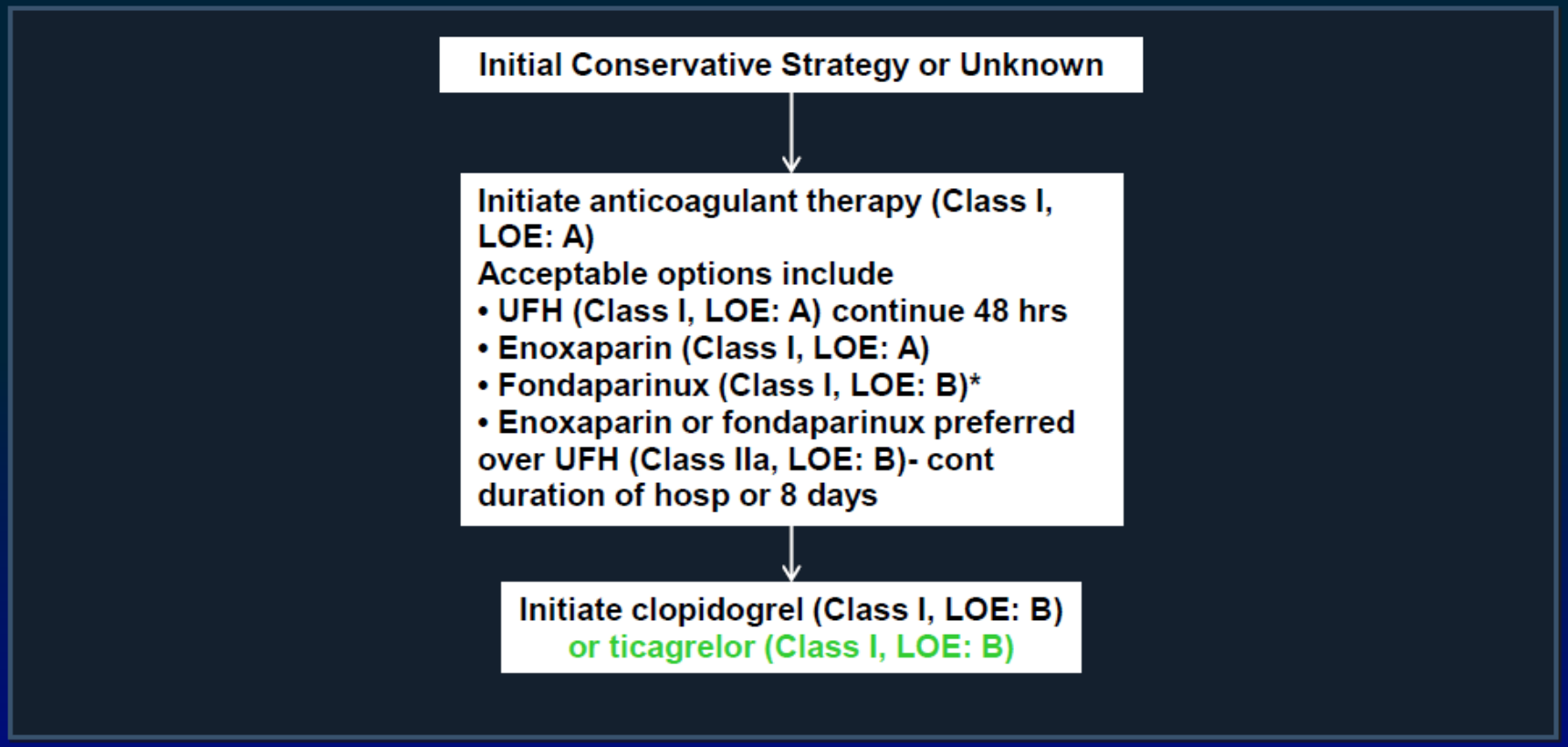


NYU Cardiovascular Clinical Research Center

Jneid et al. J Am Coll Cardiol. 2012;60(7):645-681

Treatment of Non ST-Elevation ACS

Conservative Strategy



Jneid et al. J Am Coll Cardiol. 2012;60(7):645-681

Risk stratification before discharge

- ทำในราย low หรือ Intermediate risk ที่ไม่มีเจ็บแน่นหน้าอก ไม่มีภาวะหัวใจล้มเหลว เป็นเวลาอย่างน้อย 12-24 ชั่วโมง (Class I;C)
- วิธีทดสอบขึ้นกับ resting ECG สภาพผู้ป่วยและความชำนาญหรือเทคโนโลยีที่มีอยู่ของแต่ละโรงพยาบาล (Class I;C)
- ควรใช้ Cardiac imaging สำหรับการทำ risk stratification ในรายที่ resting ECG มี ST segment depression ≥ 0.1 mv , left ventricular hyperyrophy, intraventricular conduction defects, paced-rhythm, pre-excitation (WPW syndrome) ผู้ป่วยที่ได้รับยา digoxin และมีข้อจำกัดทางกายภาพ เช่น severe COPD , peripheral vascular disease โรคข้อเข่าเสื่อม (Class I;B)

	High risk (>3% annual mortality rate)	Intermediate risk (1-3% annual mortality rate)	Low risk (< 1% annual mortality rate)
Resting LVEF (Echo or Cardiac MRI)	< 35%	35-49%	≥ 50%
Treadmill score (EST)	≤ -11	-11 ถึง 5	≥5
Stress echocardiography (Dobutamine or Exercise echo)	-> 2 segments at low dose dobutamine (10 mcg/kg/min or less) or at low heart rate - Evidence of extensive ischemia	-≤ 2 segments at high dose dobutamine	Normal
Stress-induced perfusion defects (Cardiac MRI or nuclear-Thallium or MIBI)	-Large defects (particulary if anterior) - Moderate with multiple defects - Large,fixed defect or moderate defect or stress-induced moderate defect with LV	moderate defect without LV dilatation or increase lung uptake (Thallium-201)	Normal or small defect

Treatment of Non-ST-Elevation ACS

Summary

- NSTEACS comprises >3/4th of admission for ACS
- Early risk stratification using symptoms, risk factors, EKG and biomarkers
  - Risk scores: TIMI, GRACE, PURSUIT
- Early invasive strategy association with reduction in death, MI and hospitalization for ACS especially in high-risk patients
- Early invasive strategy within 12 to 24 hours maybe reasonable in high risk patients

Topics

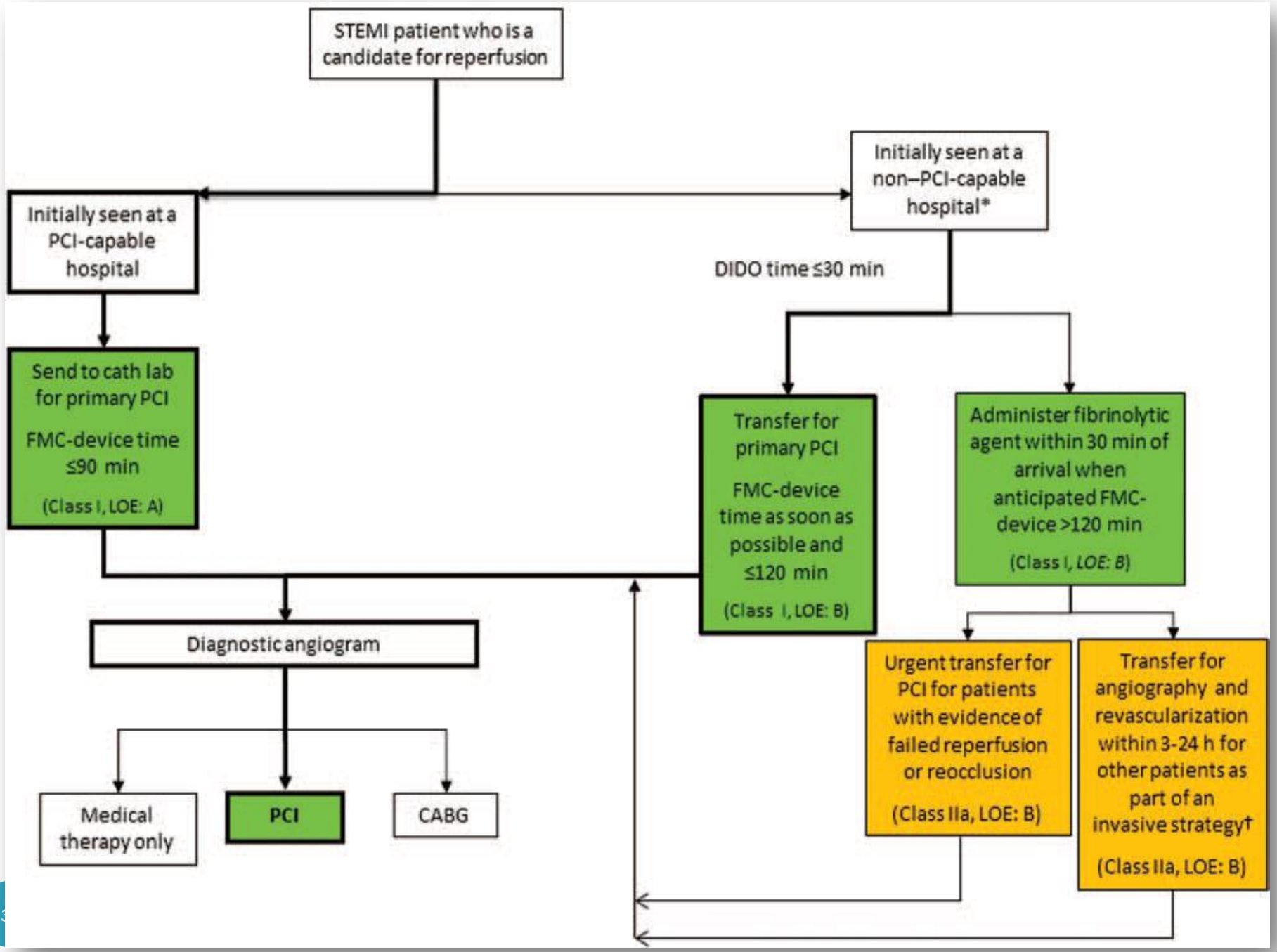
- STE-ACS , NSTE-ACS,UAP
- Diagnosis – EKG & markers (tropnin T & I)
- Management

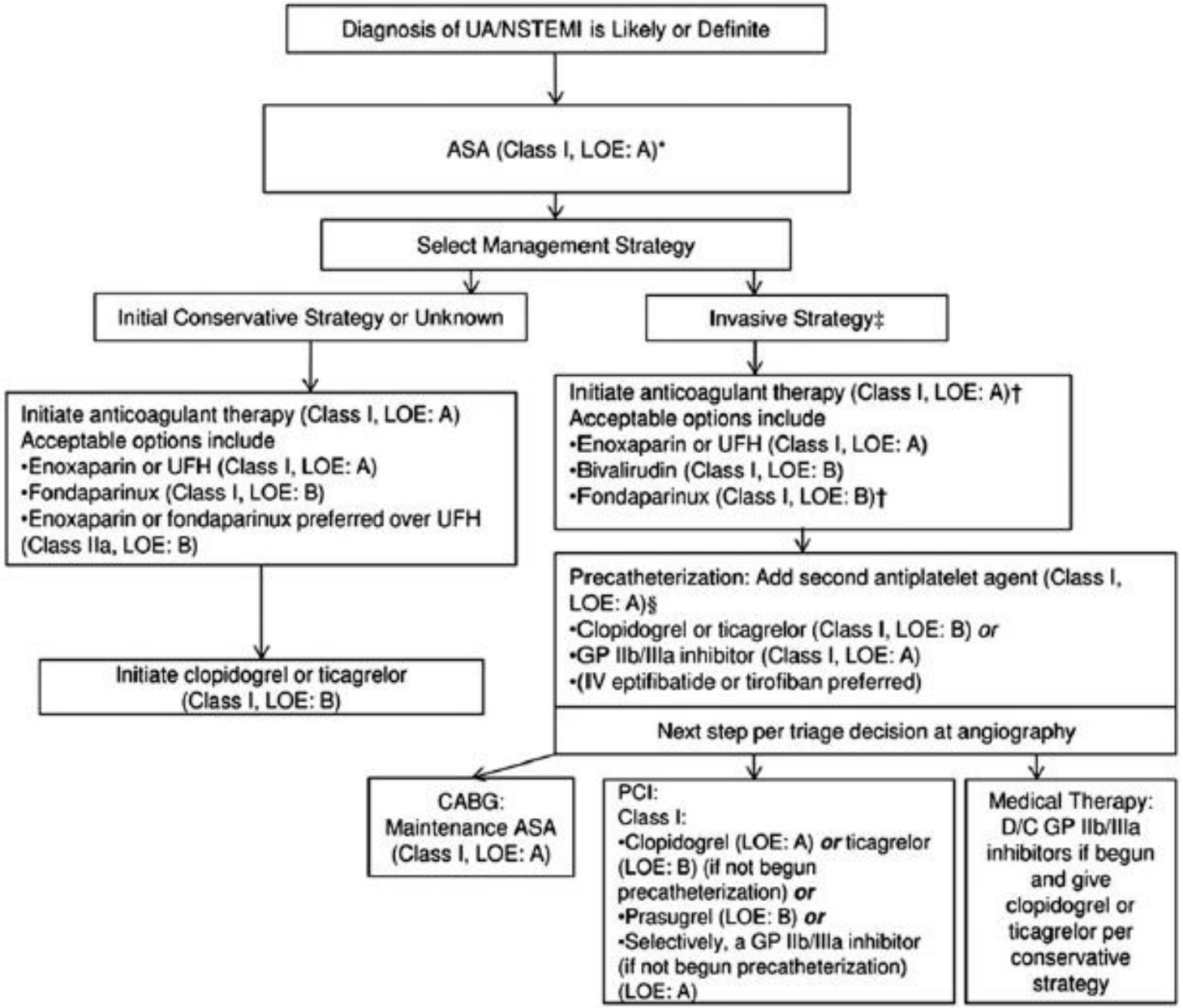
-Drugs,

-Fibrinolytics vs PPCI in STE-ACS,

-Early invasive stratergy vs. Conservative stratergy in NSTE-ACS or UAP

- Risk stratification
- Cardiac rehabiliatation
- Secondary prevention


STEMI patient who is a candidate for reperfusion
Initially seen at a PCI-capable hospital
Initially seen at a non–PCI-capable hospital*
DIDO time ≤30 min
Send to cath lab for primary PCI
FMC-device time ≤90 min
(Class I, LOE: A)
Transfer for primary PCI
FMC-device time as soon as possible and ≤120 min
(Class I, LOE: B)
Administer fibrinolytic agent within 30 min of arrival when anticipated FMC-device >120 min
(Class I, LOE: B)
Diagnostic angiogram
Urgent transfer for PCI for patients with evidence of failed reperfusion or reocclusion
(Class IIa, LOE: B)
Transfer for angiography and revascularization within 3-24 h for other patients as part of an invasive strategy†
(Class IIa, LOE: B)
Medical therapy only
PCI
CABG


Diagnosis of UA/NSTEMI is Likely or Definite
ASA (Class I, LOE: A)*
Select Management Strategy
Initial Conservative Strategy or Unknown
Invasive Strategy‡
Initiate anticoagulant therapy (Class I, LOE: A)
Acceptable options include
•Enoxaparin or UFH (Class I, LOE: A)
•Fondaparinux (Class I, LOE: B)
•Enoxaparin or fondaparinux preferred over UFH (Class IIa, LOE: B)
Initiate clopidogrel or ticagrelor (Class I, LOE: B)
Initiate anticoagulant therapy (Class I, LOE: A)†
Acceptable options include
•Enoxaparin or UFH (Class I, LOE: A)
•Bivalirudin (Class I, LOE: B)
•Fondaparinux (Class I, LOE: B)†
Precatheterization: Add second antiplatelet agent (Class I, LOE: A)§
•Clopidogrel or ticagrelor (Class I, LOE: B) or
•GP IIb/IIIa inhibitor (Class I, LOE: A)
•(IV eptifibatide or tirofiban preferred)
Next step per triage decision at angiography
CABG:
Maintenance ASA
(Class I, LOE: A)
PCI:
Class I:
•Clopidogrel (LOE: A) or ticagrelor (LOE: B) (if not begun precatheterization) or
•Prasugrel (LOE: B) or
•Selectively, a GP IIb/IIIa inhibitor (if not begun precatheterization) (LOE: A)
Medical Therapy:
D/C GP IIb/IIIa inhibitors if begun and give clopidogrel or ticagrelor per conservative strategy

การให้ยากลับบ้านในผู้ป่วย ACS

Antiplatelets

- ASA
- Clopidogrel
- or Ticagrelor

Antiangina

- Beta blocker
- Nitrate
- ± CCB

Antiatherosclerosis

- ACEI or
- ARB
- Statin

AA in pts. with poor LVEF, Influenza vaccine