ACUTE CORONARY SYNDROME

(*Last updated: 07/22/2019; Reviewers: Thierry Hernández-Gilsoul, MD; Catarina Aragon Pinto, MD)*

PRESENTING COMPLAINT: Chest pain radiating to jaw or neck, sweating, nausea/vomiting

FINDINGS

- **A** Check airway
- **B** ↑/N RR, dyspnea, shortness of breath (SOB)
- **C** ↓/↑/N BP, ↓/↑/N HR, N or weak pulse
- **D** Awake, variable altered (V,P,U,D)*
- **E** Diaphoresis, S3,gallop, mitral regurgitation murmur, rales, cyanosis
- **L_{PC}** ↑ troponin (late), lactic acidosis if shock
- **U_{PC}** Wall motion abnormalities
- **ECG** New ST-segment elevation/depression in ≥2 contiguous leads (STEMI/NSTEMI)

***V** (verbal), **P (**pain), **U** (unconsciousness), **D** (delirious)

U_{PC} (point of care ultrasound) **L_{PC}** (point of care labs)

OTHER HISTORY

- Chest pain/discomfort (diffuse, radiation to jaw/either arm, worsened by activity, improved by nitroglycerin; Levine sign), dyspnea/orthopnea, nausea, vomiting, malaise, fatigue
  - If severe: S_3, gallop, transient mitral regurgitation murmur, rales and hypoperfusion signs (diaphoresis, urine output, skin perfusion, cold extremities & mental status)
  - If signs of cardiogenic shock are present, high risk of death and measures should be taken to urgently perform revascularization and restore cardiac output.
- **Predisposing Conditions**
  - Known coronary atherosclerotic disease, diabetes mellitus, chronic kidney disease, smoking, hypertension, + family Hx, obesity, hyperlipidemia
- **Pretest Probability:** HEART, EDACS, TIMI scores predict if chest pain is due to ACS

DIFFERENTIAL DIAGNOSIS

- Acute aortic dissection, osteochondritis, pulmonary embolism, peri/myocarditis, reflux, esophageal spasm, pneumonia, spontaneous pneumothorax, thoracic Herpes-zoster, pleural effusion, chronic stable angina

OTHER INVESTIGATIONS

- **Labs:** Serial troponin, CK-MB, NT-pro-BNP, electrolytes, lactate, CBC, creatinine, BUN, liver enzymes, bilirubin

- **Monitoring:** SpO_2 and blood pressure
- Serial/Continuous ECG (compare with previous): As mentioned above; new/indeterminate left bundle branch block (non-specific, usually not a STEMI), new deep T-wave inversion or fixed Q waves; consider posterior and/or right-sided leads
- Urine output, central venous catheter if hypotension/shock
- **Imaging:** ECHO (new wall motion abnormalities, LVEF, volume status), Chest X-ray
- **Severity Scores**: TIMI and/or GRACE risk score for NSTEMI; GRACE and/or Zwolle risk score for STEMI; calculate "Contrast Nephropathy Post-PCI" risk if applicable

THERAPEUTIC INTERVENTIONS

General

- Aspirin chewable (325 mg); Nitroglycerin sublingual 0.4mg q5min up to 3 times (or IV starting at 0.1 mcg/kg/min) if no hypotension, bradycardia or evidence of right ventricular infarction (inferior STEMI); Morphine 2-4 mg q5-15min as needed (analgesia, anxiolysis) **c**an be used for chest pain or dyspnea symptoms refractory to nitroglycerin; IV beta-blocker may have similar efficacy
- Consider oral beta blocker if **stable** with heart rate between 60-100 bpm **and** systolic blood pressure >120 **and** no bradycardia/heart block, heart failure, shock or bronchospasm; IV beta-blocker may be used to control tachycardia/hypertension/angina unless cardiogenic shock
- Supplemental oxygen to maintain SpO_2 >90%; oxygen not beneficial without hypoxemia
- **Shock**: norepinephrine +/- dobutamine preferred over dopamine for vasopressor support, urgent coronary angiography; consider pulmonary artery catheter

Specific

- **Early Myocardial Reperfusion in STEMI:**
  - **Primary percutaneous coronary intervention (PCI)** preferred, with goal <90 min door-to-balloon; superior if pulmonary edema, cardiogenic shock, cardiac arrest or arrhythmias, symptom onset >3 hr, high risk score, uncertain diagnosis or contraindication to fibrinolytic
    - Ticagrelor 180mg loading then 90 mg BID (preferred) or clopidogrel 600mg loading then 75mg daily (alternative)
    - Heparin 60 U/kg bolus (max. 4000 U) +/- infusion 12 U/kg/h (max. 1000 U/h)
  - **Thrombolytic therapy** alternative if not contraindicated; consider if unable to perform timely PCI (including prolonged transfer for PCI), most effective if performed within 2-3 hours of chest pain onset but can be performed up to 6-12 hours after onset
    - Clopidogrel 300mg loading (75mg if age >75) then 75mg daily (preferred)

- Heparin 60 U/kg bolus (max. 4000 U) +/- infusion 12 U/kg/h (max. 1000 U/h); may use fondaparinux 2.5mg SQ daily as alternative if no plan for PCI

After fibrinolysis, most patients should be transferred to a PCI-capable hospital for early catheterization (typically within 6-12 hours) and PCI if indicated, sooner if clinical instability, persistent chest pain or residual ST elevation

- **Early Invasive Strategy in NSTEMI**
  - **PCI** if available in <120 min for refractory and/or recurrent angina, hemodynamic or electrical instability, acute heart failure; recommended within 12-24 hr of admission (up to 72 hr) in patients with intermediate to high risk TIMI or GRACE score (TIMI >3, GRACE ≥ 109), elevated troponin level, dynamic ECG changes, diabetes mellitus, reduced renal function, LVEF <40%, early post-MI angina, PCI within 6 months or prior CABG
  - **Conservative strategy** if PCI not indicated, i.e. low-risk patients (normal ECG and troponin) or contraindication to coronary angiography perform a stress test before discharge then routine coronary angiography if high-risk stress test features
- **Antithrombotic therapy for invasive strategy (same regimen as STEMI)**
  - Ticagrelor 180mg loading then 90 mg BID (preferred) or clopidogrel 600mg loading then 75mg daily (alternative)
  - Heparin 60 U/kg bolus (max. 4000 U) + infusion 12 U/kg/h (max. 1000 U/h) titrated to a partial thromboplastin time 1.5-2.0 times control and discontinued after PCI or up to 48h; bivalirudin may be used as an alternative at discretion of Cardiology
  - GP IIb/IIIa receptor antagonist (tirofiban, abciximab, eptifibatide) not for early routine use
- **Antithrombotic therapy for conservative strategy**
  - If definite ACS or intermediate/high clinical risk →Ticagrelor 180mg loading, then 90 mg BID (preferred) or clopidogrel 300-600mg loading then 75mg daily (alternative)
  - Unfractionated heparin (UFH) 60-70 U/kg bolus followed by 12-15 U/kg/hour; discontinue after coronary angiography or up to 48h; may use fondaparinux 2.5mg SQ daily as alternative if no plan for PCI; enoxaparin 1 mg/kg SQ Q12h may also be used for patients receiving initial non-invasive strategy, typically not used with invasive strategy
- **Other Interventions**
  - Intra-aortic Balloon Pump (IABP) – in cases of refractory chest pain, hypotension with heart failure or cardiogenic shock consider placement of IABP; no evidence of mortality benefit
  - Surgical Intervention –cardiac surgery consult to discuss bypass for severe multivessel CAD; consider **ECMO or ventricular assist device** for refractory cardiogenic shock.
  - **Consult**: Cardiology/ Catheterization Lab/Cardiac surgery

ONGOING TREATMENT

- **Monitoring**: ECG monitoring, troponin and/or CK MB if reinfarction suspected
- **Peptic ulcer prophylaxis**: Proton pump inhibitors decrease GI bleeding, with no increase in adverse cardiovascular outcomes when used in combination with clopidogrel
- **Disposition conditions**: Most patients can be discharged if they are stable and free from recurrent ischemic symptoms after 48-72 hours, to follow-up with cardiologist within 1-2 weeks
- **Long term therapies**: Aspirin indefinitely, ticagrelor or clopidogrel for at least 1 year (majority of patients), beta-blockers, Angiotensin-converting enzyme inhibitors and high dose statin (atorvastatin 40-80mg or rosuvastatin 20-40mg) prior to discharge; aldosterone antagonists in patients with LVEF <40% and heart failure or diabetes; patients requiring warfarin should receive clopidogrel for up to 1 year +/- aspirin for 1 month only

CAUTION

- Bleeding complication: Esp. elderly women, anemia, CKD ; Ventricular arrhythmias: No reduction in mortality with prophylactic antiarrhythmics; Cardiac, septal or mitral rupture: Typically occurs 3-5 days after STEMI; Heart failure; Cardiogenic shock and multi-organ failure; AV block

REFERENCES & ACKNOWLEDGMENTS

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