Acute Coronary Syndrome in the Hospital Setting

Acute Coronary Syndrome (ACS) encompasses a spectrum of conditions including unstable angina (UA), non-ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI), resulting from acute myocardial ischemia. This pamphlet provides students with a guide to diagnose, treat, and manage ACS in the hospital, including when to consult cardiology, with clinical scenarios to apply the knowledge.

Diagnosis

Clinical Presentation:

- **Symptoms:** Chest pain (substernal, pressure-like, radiating to left arm/jaw), dyspnea, nausea/vomiting, diaphoresis, lightheadedness; women/elderly may present atypically (e.g., epigastric pain, fatigue).
- **Timing:** UA/NSTEMI: Pain >20 min, new onset, or increasing frequency; STEMI: Pain >20 min with ST elevation.
- **Risk Factors:** Hypertension, diabetes, smoking, hyperlipidemia, family history of CAD, obesity.
- **Vitals/Exams:** Tachycardia, hypotension (if cardiogenic shock), S3/S4 gallop, new murmur (mitral regurgitation from papillary muscle dysfunction), crackles (heart failure).

Classification:

- **Unstable Angina (UA):** Ischemic chest pain without myocardial necrosis (negative troponin), often with EKG changes (ST depression, T-wave inversion).
- **Non-ST-Elevation MI (NSTEMI):** Ischemic chest pain with myocardial necrosis (positive troponin), EKG changes (ST depression, T-wave inversion, or normal).
- **ST-Elevation MI (STEMI):** Ischemic chest pain with myocardial necrosis (positive troponin), EKG with ST elevation (≥1 mm in 2 contiguous leads) or new left bundle branch block (LBBB).

Diagnostic Testing:

- **EKG:** First-line; STEMI: ST elevation (e.g., V1-V4 for anterior MI, II/III/aVF for inferior MI); UA/NSTEMI: ST depression, T-wave inversion, or normal.

- **Cardiac Biomarkers:**
  - **Troponin I or T:** Elevated in NSTEMI/STEMI (>99th percentile of upper reference limit); peaks 12-24h, remains elevated 7-14 days.
  - **CK-MB:** Less specific, used if troponin unavailable; rises 4-6h, peaks 12-24h, normalizes 48-72h.
- **Labs:**
  - **CBC:** Anemia (may exacerbate ischemia), leukocytosis (stress response).
  - **CMP:** Renal function (Cr for contrast dye, medication dosing), glucose (DM control), K+ (arrhythmia risk).
  - **Lipid Profile:** Assess for hyperlipidemia (LDL >100 mg/dL).
  - **Coagulation:** PT/INR, aPTT (baseline for anticoagulation).
- **Imaging:**
  - **Chest X-ray:** Cardiomegaly, pulmonary edema (heart failure), widened mediastinum (aortic dissection mimic).
  - **Echocardiogram:** Wall motion abnormalities (ischemia), reduced EF (heart failure), complications (e.g., ventricular septal rupture).
- **Risk Stratification:**
  - **TIMI Score (UA/NSTEMI):** 0-7 points (age ≥65, ≥3 CAD risk factors, prior stenosis >50%, ST deviation, ≥2 angina episodes in 24h, aspirin use in 7 days, elevated troponin); score ≥3 indicates high risk.
  - **GRACE Score:** Predicts in-hospital mortality (age, HR, SBP, Cr, cardiac arrest, ST deviation, troponin); score >140 indicates high risk.

Diagnostic Testing Table

Test	Purpose	Expected Results	Notes
EKG	Diagnose ACS Type	ST elevation (STEMI), ST depression (UA/NSTEMI)	Repeat q15-30min if initial EKG normal.
Troponin	Confirm Myocardial Necrosis (NSTEMI/STEMI)	>99th percentile	Check at 0h, 3h; peaks 12-24h.
Echocardiogram	Assess Complications	Wall motion abnormalities, low EF	Urgent if new murmur, heart failure.
Chest X-ray	Rule Out Mimics	Pulmonary edema, widened mediastinum	Aortic dissection must be excluded.

Treatment

General Principles:

- **MONA-BASH:** Initial therapy for all ACS (Morphine, Oxygen, Nitrates, Aspirin; Beta-blockers, Anticoagulation, Statins, Heparin).

- **Reperfusion:** STEMI → urgent reperfusion (PCI or thrombolytics); UA/NSTEMI →early invasive strategy if high risk.
- **Anti-Ischemic Therapy:** Reduce myocardial oxygen demand (beta-blockers, nitrates).
- **Antithrombotic Therapy:** Prevent further clot formation (aspirin, P2Y12 inhibitors, anticoagulation)
- ***Initial Management (All ACS):***
    - ***Morphine: 2-5 mg IV q5-15min (for pain relief, if nitroglycerin fails; avoid if hypotensive).***
    - ***Oxygen: Nasal cannula 2-4 L/min if SpO2 <90% or respiratory distress.***
    - ***Nitrates: Nitroglycerin 0.4 mg SL q5min x 3 doses (for pain relief; avoid if SBP <90 mmHg, recent PDE5 inhibitor use, or inferior MI with RV involvement).***
    - ***Aspirin: 325 mg PO (chewable, non-enteric coated; lifelong 81 mg PO daily thereafter).***

STEMI:

- **Reperfusion Therapy:**
    - **Primary PCI:** Preferred if door-to-balloon time <90 min (or <120 min if transferred); goal: first medical contact to device <90 min.
    - **Thrombolytics:** If PCI unavailable (<120 min): Tenecteplase 30-50 mg IV bolus (weight-based: 30 mg if <60 kg, 50 mg if ≥90 kg); contraindications include prior ischemic stroke, recent surgery, active bleeding.
- **Antithrombotic Therapy:**
    - **P2Y12 Inhibitor:** Clopidogrel 600 mg PO loading dose (or ticagrelor 180 mg PO) before PCI, then 75 mg PO daily (clopidogrel) or 90 mg PO BID (ticagrelor) x 12 months.
    - **Anticoagulation:** Heparin 60 units/kg IV bolus (max 4,000 units), then 12 units/kg/h infusion (max 1,000 units/h, target aPTT 50-70 sec); or enoxaparin 1 mg/kg SC q12h. Stopped after PCI completed
- **Anti-Ischemic Therapy:**
    - **Beta-Blockers:** Metoprolol 25-50 mg PO q6-12h (start within 24h if no contraindications: HR <60 bpm, SBP <100 mmHg, acute HF, AV block). Change to metoprolol succinate on discharge esp if CHF
    - **ACE Inhibitors:** Lisinopril 2.5-5 mg PO daily (start within 24h if EF <40% or HTN/DM; titrate to 10 mg daily).
    - **Statins:** Atorvastatin 80 mg PO daily (high-intensity, lifelong).

UA/NSTEMI:

- **Risk Stratification:**
  - High Risk (TIMI ≥3, GRACE >140, ongoing pain, dynamic EKG changes, troponin elevation): Early invasive strategy (angiography within 24h).
  - **Low Risk (TIMI 0-2, GRACE <140):** Medical management, stress test before discharge.
- **Antithrombotic Therapy:**
  - **P2Y12 Inhibitor:** Clopidogrel 300 mg PO loading dose (or ticagrelor 180 mg PO), then 75 mg PO daily (clopidogrel) or 90 mg PO BID (ticagrelor) x 12 months.
- **Anticoagulation:** Enoxaparin 1 mg/kg SC q12h (preferred) or heparin 60 units/kg IV bolus, then 12 units/kg/h infusion (target aPTT 50-70 sec); continue until PCI or 48h if medical management.
- **Anti-Ischemic Therapy:**
  - **Beta-Blockers:** Metoprolol 25-50 mg PO q6-12h (same contraindications as STEMI). Metoprolol Succinate on D/C
- **Nitrates:** Nitroglycerin IV infusion 5-20 mcg/min (titrate for pain, avoid if hypotensive).
- **ACE Inhibitors:** Lisinopril 2.5-5 mg PO daily (if EF <40% or HTN/DM).
- **Statins:** Atorvastatin 80 mg PO daily.

Supportive Care:

- **Telemetry:** Monitor for arrhythmias (VT/VF, AF).
- **Glucose Control:** Insulin infusion if glucose >180 mg/dL (target 140-180 mg/dL).
- **Treat Complications:** Furosemide 20-40 mg IV (heart failure), atropine 0.5 mg IV (bradycardia), temporary pacemaker (high-degree AV block).

Treatment Guidelines Table

Condition	Treatment	Agent/Dose	Notes
All ACS	Initial Therapy (MONA)	Aspirin 325 mg PONitroglycerin 0.4 mg SL q5min x 3	Avoid nitrates if SBP <90 mmHg.
STEMI	Reperfusion	Primary PCI (<90 min)Tenecteplase 30-50 mg IV bolus	PCI preferred; thrombolytics if PCI delayed.
UA/NSTEMI (High Risk)	Antithrombotic + Invasive Strategy	Enoxaparin 1 mg/kg SC q12hClopidogrel 300 mg PO load	Angiography within 24h if TIMI ≥3.
All ACS	Anti-Ischemic + Statin	Metoprolol 25-50 mg PO q6hAtorvastatin 80 mg PO daily	Beta-blockers contraindicated in acute HF.

Cardiology Consults

Indications:

- **STEMI:** Urgent consult for reperfusion (PCI or thrombolytics); cath lab activation immediately (door-to-balloon <90 min).
- **UA/NSTEMI (High Risk):** Ongoing chest pain, dynamic EKG changes, troponin elevation, TIMI score ≥3, GRACE score >140 → early invasive strategy (angiography within 24h).
- **Complications:** Cardiogenic shock (SBP <90 mmHg, pressor requirement), acute heart failure (pulmonary edema), ventricular arrhythmias (VT/VF), mechanical complications (e.g., papillary muscle rupture, ventricular septal defect).
- **Refractory Symptoms:** Persistent ischemia despite medical therapy (e.g., ongoing pain, ST changes).
- **Special Cases:** Suspected coronary vasospasm (Prinzmetal angina), spontaneous coronary artery dissection (SCAD), or need for advanced therapies (e.g., Impella, ECMO).

Timing:

- **Emergent:** STEMI, cardiogenic shock, mechanical complications, refractory VT/VF.
- **Urgent:** High-risk UA/NSTEMI, acute heart failure, or persistent ischemia.
- **Routine:** Low-risk UA/NSTEMI for stress testing, long-term management (e.g., revascularization planning).

Complications

Arrhythmias:

o VT/VF (5-10% of STEMI, early), AF (10-15%, often with heart failure), bradycardia (inferior MI, vagal response).

Heart Failure:

o Acute pulmonary edema (10-20%, from LV dysfunction), cardiogenic shock (5- 10%, mortality 40-50%).

Mechanical Complications (STEMI, 1-3%):

o Papillary muscle rupture (new mitral regurgitation, 1-5 days post-MI), ventricular septal rupture (VSR, 3-5 days post-MI), free wall rupture (cardiac tamponade, 1-7 days post-MI).

Other:

o Pericarditis (Dressler's syndrome, 1-4 weeks post-MI), LV thrombus (anterior MI, 5-10%, risk of stroke), recurrent ischemia (stent thrombosis, 1-2%).

Key Pearls

- **EKG First:** STEMI diagnosis requires ST elevation in 2 contiguous leads; repeat EKG q15-30min if initial normal and high suspicion.
- **Troponin:** Rises 3-6h after ischemia; check at 0h and 3h to confirm NSTEMI/STEMI.
- **Reperfusion:** STEMI → PCI <90 min; thrombolytics if PCI delayed (>120 min); UA/NSTEMI → invasive strategy if high risk (TIMI ≥3).
- **Antithrombotic:** Aspirin for all; P2Y12 inhibitors (clopidogrel/ticagrelor) + anticoagulation (heparin/enoxaparin) for most.
- **Beta-Blockers:** Start within 24h if no contraindications (acute HF, bradycardia, hypotension); improves mortality.
- **Statins:** High-intensity (atorvastatin 80 mg) for all ACS patients, lifelong.
- **Cardiology Consult:** Emergent for STEMI, urgent for high-risk UA/NSTEMI or complications (shock, heart failure).

References

- **UpToDate:** "Acute Coronary Syndrome: Diagnosis and Management" (2025).
- **AHA/ACC:** "Guideline for the Management of Patients with Acute Coronary Syndrome" (2023).
- **NEJM:** "Primary PCI vs. Thrombolytic Therapy in STEMI" (2024).
- **JACC:** "Risk Stratification in NSTEMI: TIMI and GRACE Scores" (2024).

Clinical Scenarios

Case 1: A 55-Year-Old Male with Chest Pain

- **Presentation:** A 55-year-old male with HTN, smoking history presents with substernal chest pain radiating to the left arm for 1 hour, with nausea and diaphoresis. Exam: BP 140/90 mmHg, HR 90 bpm, no murmurs, clear lungs.

- **EKG:** ST elevation in V1-V4 (anterior MI).
- **Labs:** Troponin I 2.5 ng/mL (elevated), Cr 1.0 mg/dL.
- **Diagnosis:** STEMI (Anterior Wall) → ST elevation in V1-V4, elevated troponin.
- **Management:** Aspirin 325 mg PO, nitroglycerin 0.4 mg SL x 3 (pain relief), heparin 60 units/kg IV bolus, then 12 units/kg/h infusion. Clopidogrel 600 mg PO load. Emergent cardiology consult for primary PCI (door-to-balloon <90 min). Start metoprolol 25 mg PO q12h (if stable post-PCI). Atorvastatin 80 mg PO daily. Monitor telemetry for VT/VF, echo for wall motion abnormalities.

Case 2: A 65-Year-Old Female with Epigastric Pain

- **Presentation:** A 65-year-old female with DM, HTN presents with epigastric pain and dyspnea for 2 hours. Exam: BP 160/100 mmHg, HR 100 bpm, crackles in lung bases (heart failure).
- **EKG:** ST depression in V4-V6, T-wave inversion.
- **Labs:** Troponin I 1.8 ng/mL (elevated), BNP 800 pg/mL, Cr 1.2 mg/dL.
- **Diagnosis:** NSTEMI with Acute Heart Failure → ST depression, elevated troponin, heart failure signs.
- **Management:** Aspirin 325 mg PO, nitroglycerin IV 5 mcg/min (titrate for pain), enoxaparin 1 mg/kg SC q12h, ticagrelor 180 mg PO load. Furosemide 40 mg IV for heart failure. TIMI score: 4 (age ≥65, HTN, DM, ST deviation, troponin); urgent cardiology consult for early invasive strategy (angiography within 24h). Start metoprolol 25 mg PO q12h (once HF stabilizes). Atorvastatin 80 mg PO daily. Monitor telemetry, renal function, and respiratory status.

Case 3: A 70-Year-Old Male with Syncope

- **Presentation:** A 70-year-old male with CAD history presents with chest pain and syncope for 30 minutes. Exam: BP 90/60 mmHg, HR 40 bpm, new murmur (mitral regurgitation).
- **EKG:** ST elevation in II, III, aVF (inferior MI), complete heart block.
- **Labs:** Troponin I 3.0 ng/mL (elevated), Cr 1.5 mg/dL.
- **Diagnosis:** STEMI (Inferior Wall) with Complete Heart Block → ST elevation in II/III/aVF, bradycardia, syncope.
- **Management:** Aspirin 325 mg PO, heparin 60 units/kg IV bolus, then 12 units/kg/h infusion. Avoid nitroglycerin (inferior MI, risk of RV involvement). Clopidogrel 600 mg PO load. Emergent cardiology consult for primary PCI. Atropine 0.5 mg IV (bradycardia), prepare for temporary pacemaker. Start atorvastatin 80 mg PO daily. Echo
- to assess for papillary muscle rupture (new murmur). Monitor telemetry for worsening AV block, VT/VF.

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