Overview of Pericarditis, Myocarditis, and Endocarditis

Pericarditis, myocarditis, and endocarditis are inflammatory cardiac conditions frequently encountered in hospital medicine, each affecting a distinct layer of the heart—pericardium, myocardium, and endocardium, respectively. These conditions range from self-limiting (e.g., viral pericarditis) to life-threatening (e.g., bacterial endocarditis with sepsis), with significant morbidity if untreated. Pericarditis has an incidence of ~27.7 cases per 100,000 person-years, myocarditis ~22 per 100,000, and endocarditis ~12.7 per 100,000 (CDC, 2023). Hospitalists play a critical role in early recognition, diagnostic workup, and management, often coordinating with cardiology and infectious disease specialists. This pamphlet provides a comprehensive overview of pericarditis, myocarditis, and endocarditis, including clinical presentation, pathophysiology, labs/tests, complications, causes, treatment, hospitalist implications, and includes tables and clinical scenarios for practical application.

Pathophysiology

Pericarditis:

- Mechanism:
  - Inflammation of the pericardium (the sac surrounding the heart), often due to viral infection, autoimmune response, or injury, leading to fluid accumulation (effusion) or fibrosis.
- Response:
  - Inflammatory mediators (e.g., IL-1, TNF-α) cause pericardial irritation, resulting in chest pain and potential complications like tamponade.

Myocarditis:

- Mechanism:
  - Inflammation of the myocardium (heart muscle), typically viral (e.g., coxsackievirus), causing myocyte necrosis, immune-mediated damage, and possible progression to dilated cardiomyopathy.
- Response:
  - Cytokine storm and T-cell infiltration impair contractility, leading to heart failure or arrhythmias.

Endocarditis:

- Mechanism:
  - Infection of the endocardium (inner heart lining, usually valves), often bacterial (e.g., Staphylococcus aureus), forming vegetations that can embolize or cause valve destruction.
- Response:
  - Bacterial seeding (e.g., via IV drug use, dental procedures) triggers immune complex deposition, leading to systemic inflammation, sepsis, and organ damage.

Causes

Pericarditis:

- Infectious:
  - Viral (coxsackievirus, influenza), bacterial (TB, S. pneumoniae), fungal (histoplasmosis).
- Non-Infectious:
  - Autoimmune (SLE, rheumatoid arthritis), post-MI (Dressler's syndrome), uremia, malignancy (lung, breast cancer), radiation.

Myocarditis:

- Infectious:
  - Viral (coxsackievirus, parvovirus B19, HHV-6), bacterial (diphtheria), parasitic (Chagas disease).
- Non-Infectious:
  - Autoimmune (giant cell myocarditis), toxins (alcohol, cocaine), hypersensitivity (drugs like sulfonamides).

Endocarditis:

- Infectious:
  - S. aureus (IV drug use, acute), Streptococcus viridans (subacute, dental), Enterococcus (GU source), HACEK organisms, fungal (Candida).
- Non-Infectious:
  - Libman-Sacks endocarditis (SLE), marantic endocarditis (malignancy).

Clinical Presentation

Pericarditis:

- Symptoms:
  - Sharp, pleuritic chest pain (improves leaning forward), fever, dyspnea.
- Physical Exam:
  - Pericardial friction rub (triphasic sound), tachycardia, muffled heart sounds (effusion).
- Severity:
  - Positional pain (worsens lying down), may mimic MI (diffuse ST elevation).

Myocarditis:

- Symptoms:
  - Chest pain, fatigue, dyspnea, palpitations, recent viral prodrome (fever, myalgias).
- Physical Exam:
  - Tachycardia, S3 gallop (heart failure), signs of CHF (crackles, edema), arrhythmias.
- Severity:
  - Ranges from mild (asymptomatic) to severe (cardiogenic shock, sudden cardiac death).

Endocarditis:

- Symptoms:
  - Fever, chills, fatigue, new murmur, systemic symptoms (weight loss, night sweats).
- Physical Exam:
  - Janeway lesions (palms/soles), Osler’s nodes (painful fingertips), Roth spots (retinal hemorrhages), splinter hemorrhages (nail beds), petechiae.
- Severity:
  - Acute (rapid onset, S. aureus) vs. subacute (insidious, S. viridans).

Diagnostic Studies

Labs:

- Pericarditis:
  - **CBC:** Leukocytosis (>12,000/µL, infection), anemia (uremia, malignancy).
  - **Inflammatory Markers:** ESR/CRP elevated.
  - **Troponin:** May be elevated (myopericarditis).
- Myocarditis:
  - **Troponin:** Elevated (>0.5 ng/mL, myocyte damage).
  - **BNP:** Elevated (>400 pg/mL, heart failure).
  - **Viral Serologies:** Often negative, but consider coxsackievirus, parvovirus.
- Endocarditis:
  - **Blood Cultures:** ≥3 sets before antibiotics (positive in 90% of cases).
  - **CBC:** Leukocytosis, anemia of chronic disease.
  - **ESR/CRP:** Elevated, monitor response to therapy.
  - **UA:** Hematuria (emboli), glomerulonephritis.

Imaging:

- Pericarditis:
  - **ECG:** Diffuse ST elevation, PR depression.
  - **Echo:** Pericardial effusion, tamponade (RV collapse, IVC plethora).
  - **CT/MRI:** Pericardial thickening, effusion.
- Myocarditis:
  - **ECG:** Non-specific ST/T changes, AV block, ventricular tachycardia.
  - **Echo:** Global hypokinesis, reduced EF (<50%), wall motion abnormalities.
  - **Cardiac MRI:** Late gadolinium enhancement (LGE), edema (T2-weighted).
- Endocarditis:
  - **Echo:** TTE/TEE for vegetations (TEE sensitivity >90%), valve dysfunction, abscess.
  - **CT/MRI:** Emboli (e.g., stroke, splenic infarct), abscess.

Other Tests:

- Pericarditis:
  - **Pericardiocentesis (if tamponade, purulent effusion):** Analyze fluid (cell count, culture, cytology).

- Myocarditis:
  - **Endomyocardial biopsy (gold standard, rarely done):** Myocyte necrosis, lymphocytic infiltration.
- Endocarditis:
  - **Duke Criteria (major:** positive blood cultures, echo findings; minor: fever, embolic phenomena, predisposition).

Complications

Pericarditis:

- **Cardiac Tamponade:** 5-15% incidence, hypotension, pulsus paradoxus, muffled heart sounds.
- **Constrictive Pericarditis:** Chronic, 1-2% incidence, right heart failure (edema, JVD).
- **Recurrence:** 15-30% incidence, often autoimmune.

Myocarditis:

- **Dilated Cardiomyopathy:** 20-30% incidence, chronic heart failure, EF <40%.
- **Arrhythmias:** 10-20% incidence, VT/VF, sudden cardiac death.
- **Cardiogenic Shock:** 5-10% incidence, mortality 20-40%.

Endocarditis:

- **Embolization:** 20-50% incidence, stroke, splenic infarct, septic pulmonary emboli.
- **Valve Destruction:** 30-40% incidence, acute heart failure, regurgitation.
- **Sepsis/Septic Shock:** 20-30% incidence, mortality 30-50%.
- **Perivalvular Abscess:** 10-20% incidence, conduction abnormalities (AV block).

Treatment Strategies

Pericarditis:

- Treatment:
  - **Anti-Inflammatory:** NSAIDs (ibuprofen 600 mg PO TID x 1-2 weeks), aspirin 650 mg PO TID (post-MI).
  - **Colchicine:** 0.5 mg PO BID x 3 months (reduces recurrence).
  - **Steroids:** Prednisone 0.5 mg/kg/day PO (refractory, autoimmune), taper slowly.

    - **Pericardiocentesis:** If tamponade or large effusion (>20 mm).
    - Duration: 2-4 weeks (NSAIDs), 3 months (colchicine).
- Supportive:
    - Rest, monitor for tamponade (echo q24h if effusion).

Myocarditis:

- Treatment:
    - **Supportive:** Heart failure management (furosemide 20-40 mg IV, ACEi like lisinopril 5-10 mg PO daily), avoid NSAIDs (worsen inflammation).
    - **Antiviral:** Rarely used (e.g., ganciclovir for CMV, limited evidence).
    - **Immunosuppression:** Steroids (prednisone 1 mg/kg/day) for giant cell myocarditis (biopsy-confirmed).
    - **Arrhythmias:** Amiodarone 150 mg IV bolus (VT), temporary pacing (AV block).
    - **Mechanical Support:** ECMO/IABP for cardiogenic shock.
- Duration:
    - Supportive until EF improves, immunosuppression 3-6 months if indicated.
- Supportive:
    - Monitor EF (echo q48h), telemetry (arrhythmias).

Endocarditis:

- Treatment:
    - **Antibiotics:**
        - **Native Valve (S. viridans):** Ceftriaxone 2 g IV daily x 4 weeks.
        - **Native Valve (S. aureus):** Vancomycin 15 mg/kg IV q12h (if MRSA) or nafcillin 2 g IV q4h (if MSSA) x 4-6 weeks.
        - **Prosthetic Valve:** Vancomycin + gentamicin 1 mg/kg IV q8h + rifampin 300 mg PO TID x 6 weeks.
        - **Surgery:** Valve replacement for heart failure, abscess, large vegetations (>10 mm), recurrent emboli.
        - Duration: -6 weeks (longer for prosthetic valves, S. aureus).
    - Supportive: Monitor blood cultures q48h until negative, echo qweek (vegetations).

Hospital Medicine Implications

Early Recognition:

- **Pericarditis:** Pleuritic chest pain, ECG changes (ST elevation).

- **Myocarditis:** Viral prodrome, heart failure, arrhythmias.
- **Endocarditis:** Fever, new murmur, embolic phenomena (use Duke Criteria).

Consultations:

- **Cardiology:** For echo, heart failure management, surgical indications.
- **ID:** For endocarditis antibiotic selection, CDI risk.
- **Cardiothoracic Surgery:** For endocarditis (valve replacement), pericarditis (pericardiectomy).

Monitoring:

- Vitals q4h (fever, tachycardia, hypotension).
- Labs q12-24h (troponin, BNP, ESR/CRP, cultures).
- Echo q48h (effusion, vegetations, EF).

Discharge Planning:

- **Antibiotics:** Complete IV/PO course (e.g., ceftriaxone for endocarditis).
- **Follow-Up:** Cardiology, ID within 1 week.
- **Education:** Activity restriction (myocarditis), recurrence signs (fever, chest pain).

Table: Pericarditis, Myocarditis, and Endocarditis - Key Features

Condition	Presentation	Pathophysiology	Labs/Tests	Complications	Treatment
Pericarditis	Pleuritic chest pain, rub	Pericardial inflammation	ECG: ST elevation, echo: Effusion	Tamponade, constrictive pericarditis	NSAIDs, colchicine, pericardiocentesis
Myocarditis	Chest pain, heart failure	Myocyte necrosis, inflammation	Troponin >0.5 ng/mL, MRI: LGE	Cardiomyopathy, arrhythmias	Supportive, steroids (giant cell), ECMO
Endocarditis	Fever, new murmur, emboli	Endocardial infection, vegetations	Blood cultures, echo: Vegetations	Embolization, valve destruction	Antibiotics (ceftriaxone, vancomycin), surgery

Table: Hospitalist Management Checklist

Task	Pericarditis	Myocarditis	Endocarditis	Monitoring	Consults
Initial Diagnosis	ECG, echo, CRP	Troponin, MRI, echo	Blood cultures, TEE	Vitals q4h, labs q12h	Cardiology, ID

Task	Pericarditis	Myocarditis	Endocarditis	Monitoring	Consults
Treatment	NSAIDs, colchicine	Supportive, heart failure meds	Antibiotics, surgery	Echo q48h, cultures q48h	Cardiothoracic surgery
Supportive Care	Pain control, rest	Avoid NSAIDs, telemetry	Monitor for emboli, heart failure	Troponin, BNP q24h	Cardiology, ID
Follow-Up	Cardiology follow-up	Monitor EF, activity restriction	Complete antibiotics, echo	Labs q24h, exam qshift	ID, primary care

Clinical Scenarios

Scenario 1: Young Male with Acute Pericarditis

- Presentation: A 30-year-old male presents with 2 days of sharp chest pain worsening with inspiration, improved by leaning forward, and low-grade fever. Exam shows T 38°C, BP 120/80 mmHg, HR 90 bpm, RR 18/min, pericardial friction rub.
- Diagnostic Workup: **ECG:** Diffuse ST elevation, PR depression, echo: Small effusion (5 mm), no tamponade, labs: CRP 50 mg/L, troponin 0.1 ng/mL, WBC 10,000/µL.
- Diagnosis: Acute pericarditis → Pleuritic pain, ECG changes, rub.
- Management: Admit to medicine (pericarditis). Start ibuprofen 600 mg PO TID x 2 weeks, colchicine 0.5 mg PO BID x 3 months. Monitor echo q48h (effusion stable), ECG q24h. Day 3: Pain improved, afebrile, discharged with cardiology follow-up.

Scenario 2: Middle-Aged Female with Myocarditis and Heart Failure

- Presentation: A 40-year-old female presents with 1 week of fatigue, dyspnea, and palpitations after a viral illness. Exam shows T 37.5°C, BP 100/60 mmHg, HR 110 bpm, RR 20/min, crackles, S3 gallop.
- Diagnostic Workup: **Troponin 1.2 ng/mL, BNP 800 pg/mL, ECG:** Non-specific ST changes, echo: EF 30%, global hypokinesis, MRI: LGE in septum, viral serologies negative.
- Diagnosis: Myocarditis → Viral prodrome, heart failure, reduced EF.

- Management: Admit to telemetry (myocarditis). Start furosemide 20 mg IV BID, lisinopril 5 mg PO daily. Avoid NSAIDs. Consult cardiology: Amiodarone 150 mg IV bolus (VT episode). Monitor echo q48h, telemetry (arrhythmias). Day 5: EF 35%, symptoms improved, discharged with cardiology follow-up, activity restriction.

Scenario 3: Elderly Male with Endocarditis and Embolization

- Presentation:A 65-year-old male with a history of IV drug use presents with 2 weeks of fever, chills, and new-onset left-sided weakness. Exam shows T 39°C, BP 110/70 mmHg, HR 100 bpm, RR 18/min, new systolic murmur (mitral), Janeway lesions, left hemiparesis.
- Diagnostic Workup: **Blood cultures:** S. aureus (3/3 sets), TEE: 12 mm vegetation on mitral valve, CT brain: Right MCA stroke, labs: WBC 18,000/µL, Cr 1.5 mg/dL, ESR 80 mm/h.
- Diagnosis: Infective endocarditis → Fever, murmur, embolic phenomena, positive cultures (meets Duke Criteria).
- Management: Admit to ICU (endocarditis, stroke). Start vancomycin 15 mg/kg IV q12h (MRSA suspected). Consult cardiothoracic surgery: Mitral valve replacement planned (large vegetation, emboli). Consult neurology: Stroke management. Monitor blood cultures q48h (negative by day 5), echo qweek. Day 14: Post-op, antibiotics continued x 6 weeks, discharged with ID follow-up.