Cardiology Knowledge Base

Cardiovascular Anatomy and Physiology

Heart Structure

The human heart is a four-chambered muscular organ consisting of:
- **Right Atrium**: Receives deoxygenated blood from systemic circulation
- **Right Ventricle**: Pumps blood to pulmonary circulation
- **Left Atrium**: Receives oxygenated blood from pulmonary circulation
- **Left Ventricle**: Pumps blood to systemic circulation

Cardiac Cycle

The cardiac cycle consists of two main phases:
1. **Systole**: Ventricular contraction and blood ejection
2. **Diastole**: Ventricular relaxation and filling

Electrocardiography (ECG)

Standard 12-lead ECG interpretation:
- **P Wave**: Atrial depolarization
- **QRS Complex**: Ventricular depolarization
- **T Wave**: Ventricular repolarization
- **Normal Intervals**: PR (120-200ms), QRS (<120ms), QT (varies with heart rate)

Common Cardiovascular Conditions

Coronary Artery Disease (CAD)

- **Pathophysiology**: Atherosclerotic plaque formation in coronary arteries
- **Risk Factors**: Hypertension, diabetes, smoking, hyperlipidemia, family history
- **Symptoms**: Chest pain, shortness of breath, fatigue
- **Diagnosis**: Stress testing, coronary angiography, CT angiography
- **Treatment**: Lifestyle modifications, medications (statins, ACE inhibitors), revascularization

Heart Failure

- **Types**: Heart failure with reduced ejection fraction (HFrEF), Heart failure with preserved ejection fraction (HFpEF)

- **Symptoms**: Dyspnea, fatigue, edema, orthopnea
- **Diagnosis**: Echocardiography, BNP/NT-proBNP, chest X-ray
- **Treatment**: ACE inhibitors, beta-blockers, diuretics, device therapy

Arrhythmias

- **Atrial Fibrillation**: Irregular atrial rhythm, stroke risk
- **Ventricular Tachycardia**: Life-threatening arrhythmia
- **Bradyarrhythmias**: Slow heart rhythms, may require pacing

Diagnostic Procedures

Echocardiography

- **Transthoracic Echo (TTE)**: Non-invasive cardiac imaging
- **Transesophageal Echo (TEE)**: More detailed imaging via esophageal probe
- **Parameters**: Ejection fraction, wall motion, valve function

Cardiac Catheterization

- **Indications**: Coronary artery assessment, hemodynamic evaluation
- **Complications**: Bleeding, contrast nephropathy, arrhythmias
- **Post-procedure Care**: Vascular access site monitoring, hydration

Treatment Protocols

Acute Coronary Syndrome (ACS)

1. **Initial Assessment**: ECG, cardiac biomarkers, chest X-ray
2. **Risk Stratification**: TIMI score, GRACE score
3. **Treatment**: Antiplatelet therapy, anticoagulation, revascularization
4. **Secondary Prevention**: Statin therapy, beta-blockers, lifestyle counseling

Hypertension Management

- **Target BP**: <130/80 mmHg for most patients
- **First-line Medications**: ACE inhibitors, ARBs, thiazide diuretics, calcium channel blockers
- **Lifestyle Modifications**: Diet, exercise, weight loss, sodium restriction

Emergency Cardiac Care

Cardiopulmonary Resuscitation (CPR)

- **Compression Rate**: 100-120 per minute
- **Compression Depth**: At least 2 inches (5 cm)
- **Ventilation**: 30:2 compression to ventilation ratio

Advanced Cardiac Life Support (ACLS)

- **Ventricular Fibrillation/Pulseless VT**: Immediate defibrillation
- **Asystole/PEA**: High-quality CPR, epinephrine, identify reversible causes
- **Post-cardiac Arrest Care**: Targeted temperature management, hemodynamic support

Preventive Cardiology

Risk Assessment

- **Framingham Risk Score**: 10-year cardiovascular risk prediction
- **ACC/AHA Risk Calculator**: Updated risk assessment tool
- **Coronary Artery Calcium Score**: Non-invasive atherosclerosis assessment

Primary Prevention

- **Lifestyle Interventions**: Mediterranean diet, regular exercise, smoking cessation
- **Pharmacological**: Statin therapy for high-risk patients
- **Screening**: Blood pressure, lipid profile, diabetes screening