



Cardiovascular Assessment

This pocket reference gives nurses quick and convenient cardiovascular information, including:

- Assessing heart sounds, murmurs, clicks, and rubs
- Distinguishing among types of chest pain
- Distinguishing between arterial and venous insufficiency
- Analyzing cardiac enzyme and electrolyte laboratory data
- Evaluating for signs and symptoms of cardiovascular compromise
- Evaluating pacemaker settings and functionality

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Acute Coronary Syndrome

The location of the blockage, the length of time that blood flow is reduced or blocked, and the amount of damage that occurs determine whether the type is unstable angina, STEMI, or NSTEMI.

- **Unstable Angina** - angina that occurs more frequently, occurs more easily at rest, lasts longer, and is more severe. Often relieved with oral medication but still may progress to an MI.
- **ST Segment Elevation Myocardial Infarction (STEMI)** - changes in chemical biomarkers in blood caused by a prolonged phase of blocked blood supply. Named for ST segment elevation that occurs in the electrocardiogram (ECG).
- **Non-ST Segment Elevation Myocardial Infarction (NSTEMI)** - may produce ST segment depression or inverted T waves; on occasion, it causes no discernable ECG changes. Chemical biomarkers indicate damage has occurred to the heart muscle. The blockage may be temporary or partial.

General Assessment (objective)

Vital Signs

- Blood pressure
- Heart rate
- Rhythm

ECG Strips - lead, time, date, rate, and rhythm

- T wave abnormalities
- ST segment changes
- P-R interval
- QRS interval
- QT interval

Tissue Perfusion

- Color and temperature of skin
- Nail color and capillary refill
- Presence of edema
- Heart sounds

General Chest Pain Assessment (subjective)

P (Provoke)
Q (Quality)
R (Radiation)
S (Severity)
T (Timing)



Differential Diagnosis of Chest Pain

Diagnosis	Type of Pain
Angina	Sudden substernal, tight, heavy, chest, jaw, neck, and arm. May radiate. Usually less than 15 min. Relieved by oxygen and nitroglycerin.
Myocardial Infarction	Sudden, same as above but worse, lasts longer. May have nausea, vomiting, diaphoresis, shortness of breath, instead of "pain." Usually unrelieved by oxygen and nitroglycerin.
Dissecting Aortic Aneurysm	Sudden substernal chest pain. May radiate to back, neck, and legs. May have different BPs in arms.
Esophageal/Peptic Ulcer	Substernal or epigastric. Increases when supine or eating. Decreases with antacids.
Pericarditis	Sudden substernal, constant, sharp. Increases with lying supine and deep breathing. Decreases when leaning forward.
Pulmonary Edema	Sudden onset, sharp, shortness of breath, diffuse. Increases with deep breathing.
Musculo-skeletal	Superficial. Increases with palpation or is reproducible with movement.
Pleuritic	Substernal or on 1 side, shooting. Increases with coughing or deep inspiration.



Heart Sounds

S₁	Normal, forms the “lub” of lub-dub. Caused by blood flow against the closed atrioventricular valves (mitral and tricuspid).
S₂	Normal, forms the “dub” of lub-dub. Caused by blood flow against the aortic and pulmonic valves.
S₃	Extra heart sound. Sometimes called the ventricular gallop and occurs at the beginning of diastole after S ₂ , and is lower in pitch than S ₁ and S ₂ . Not of valvular origin. May signal a failing left ventricle or heart failure.
S₄	Rare, extra heart sound. Referred to as an atrial gallop, which is produced by blood being forced into a noncompliant or hypertrophic ventricle.



Murmurs - produced by turbulent, rapid blood flow. Heard as a “whooshing” sound.

Grade I	Very faint; may not be audible in all positions.
Grade II	Quiet, but heard immediately after placing stethoscope on chest.
Grade III	Moderately loud.
Grade IV	Loud, with a palpable thrill.
Grade V	Very loud with a thrill. May be heard if stethoscope partially off chest.
Grade VI	Very loud with thrill. May be heard with stethoscope entirely off chest.

Other Abnormal Sounds

Clicks	Short, high-pitched sound. May be appreciated in patients diagnosed with mitral stenosis in which the AV valves have an “opening snap” at the beginning of diastole. Aortic and pulmonary stenosis may cause an ejection click immediately after S ₁ .
Rubs	Scratching, high-pitched sound produced when layers of the pericardium rub together. Loudest in systole. Often heard at beginning and end of diastole. Changes hourly and is dependent on body position.



Laboratory Data/Biomarkers

*Peak times may be altered with reperfusion interventions (ie, percutaneous coronary intervention)

Chemical Marker/ Biomarker	Rises	Peaks*	Returns to Normal	Clinical Significance
Troponin I (normal < 0.03 ng/mL)	3 h	14-24 h*	5-7 d	Differentiating cardiac from noncardiac chest pain. Evaluation of patient with unstable angina. Detection of reperfusion and perioperative MI. Estimation of MI size.
Troponin T (normal < 0.2 ng/mL)	3-5 h	10-24 h*	14-21 d	Differentiating cardiac from noncardiac chest pain. Evaluation of patient with unstable angina. Detection of reperfusion and perioperative MI. Estimation of MI size.
Total CK (normal = adult/older adult male: 55 - 170 units/L female: 30 - 135 units/L)	4-6 h	24 h*	3-4 d	Reliably indicates acute MI.
CK-MB (normal = 0%)	4 h	18 h*	2 d	Acute MI, cardiac aneurysm surgery, defibrillation, myocarditis, ventricular arrhythmias.
Myoglobin (normal = 0 - 0.09 mcg/mL)	2 h	6-7 h*	1 d	↑ levels related to MI, myositis, malignant hyperthermia, muscular dystrophy, seizures.



Laboratory Data/Electrolytes

Chemical Marker	Hypo-clinical Significance	Hyper-clinical Significance
Sodium (Na) (normal 136-145 mEq/L)	Tachycardia, hypotension, or hypertension	Weak, thready pulse, tachycardia

Arterial Insufficiency of Lower Extremities

Pulses	↓ or absent
Color	Pale on elevation/dusky rubor on dependency
Temperature	Cool/cold

Potassium (K) (normal 3.5-5.0 mEq/L)	Flat T waves; ST depression, U wave; ventricular arrhythmias	Peaked T waves, wide QRS, ↑ PR interval, asystole, acidosis
Calcium (Ca) (normal= total 9.5-10.5 mg/dL; ionized 1.05-1.30 mmol/L) ionized level is unaffected by changes in serum albumin levels	↑ QT interval, dysrhythmias, irregular pulse	↓ QT interval, hypertension
Magnesium (Mg) (normal 1.3-2.1 mEq/L)	↑ ventricular arrhythmias, cardiac irritability	Widened PR interval, QT intervals with wide QRS

Edema	None
Skin	Shiny, thick nails, no hair. Ulcers on toes
Sensation	Pain (more with exercise), paresthesias

Venous Insufficiency of Lower Extremities

Pulses	Present
Color	Pink to cyanotic, brown pigment at ankles
Temperature	Warm
Edema	Present
Skin	Discolored, scaly. Ulcers on ankles
Sensation	Pain (more with standing or sitting) Relieved with elevation/support hose

Types of Myocardial Infarction

Type	Artery	Indicative Leads	Reciprocal Leads	Associated Complications
Inferior	RCA	II, III, aVf	I, aVL, V5, V6	AV block, ↓HR, papillary muscle rupture, ↓BP, nausea, vomiting, hiccups
Septal	LAD	V1, V2	II, III, aVF	VSD
Anterior	LAD	V1, V2, V3, V4	II, III, aVF	2nd degree Type 2 block, RBBB, LAHB, complete block, heart failure, cardiogenic shock

Lateral	LCx, LAD	I, aVL, V5, V6	II, III, aVF	Ventricular aneurysm
Antero/lateral	LAD, Cx	V1, V2, V3, V4, V5, V6	II, III, aVF	Ventricular aneurysm
Apical RVI	LAD, RCA, LCx	V5, V6	I, III, aVF	Ventricular aneurysm
RVI	RCA	V3r, V4r		RV failure, AV block
Posterior	RCA, LCx	none	V1, V2 reciprocal	AV block, bradycardia

Legend: AV, atrioventricular; BP, blood pressure; CK, creatine kinase; CK-MB, creatine kinase myocardial band; LAD, left anterior descending artery; LAHB, left anterior hemiblock; LCx, circumflex branch of left coronary artery; MI, myocardial infarction; RBBB, right bundle branch block; RCA, right coronary artery; RV, right ventricular; RVI, right ventricular infarct; VSD, ventricular septal defect

Pacemaker Settings

1st Letter Chamber Paced	2nd Letter Chamber Sensed	3rd Letter Mode of Response	4th Letter Programmability	5th Letter Antitachycardia Function
A = Atrium	A = Atrium	I = Inhibit	P = Simple	P = Pace
V = Ventricle	V = Ventricle	T = Trigger	M = Multiprogram	S = Shock
D = Dual chambers	D = Dual chambers O = No sensing	Dual (I and/or T) O = No pacemaker response	C = Communication R = Rate modulating	D = Pace and shock

Troubleshooting Pacemaker Functionality

Failure to Pace

(No pacemaker spike visible at appropriate time)

- | | | |
|-----------|---|---|
| Caused by | <ul style="list-style-type: none"> • Dislodged lead • Battery failure • Fractured wire • Disconnected wire • Generator failure | <ul style="list-style-type: none"> • Oversensing: pacemaker misinterpreting another activity as a QRS complex usually muscular in nature |
|-----------|---|---|

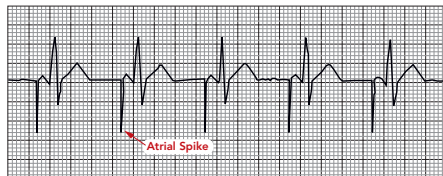
Failure to Capture (Pacer-generated, QRS not visible)

- | | | |
|-----------|---|--|
| Caused by | <ul style="list-style-type: none"> • Dislodged lead • Malpositioned lead • Battery failure • Faulty connections | <ul style="list-style-type: none"> • Fractured lead • Perforated ventricle • Pacing at voltage < capture threshold |
|-----------|---|--|

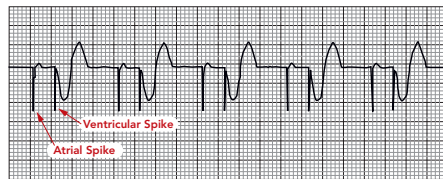
Failure to Sense (Pacemaker may compete with patient's own intrinsic rhythm)

- | | | |
|-----------|---|--|
| Caused by | <ul style="list-style-type: none"> • Sensitivity set too high • Catheter lead malpositioned | <ul style="list-style-type: none"> • Fractured lead • Pulse generator failure • Break in lead insulation • Battery failure |
|-----------|---|--|

Atrial Pacing



A-V Sequential Pacing



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