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Intern Tips in

Intern Tips in Internal Medicine

(Tips in Inpatient Rotations Internal Medicine, Family Medicine and ICU)



Editors
Lorenzo Aragon
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CHAPTER 2

Cardiac Section

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CHAPTER OUTLINE

- *Murmurs*
- *Code Blue*
- *Tachycardia*
- *Narrow Complex Tachycardia*
- *Atrial Fibrillation*
- *Chest Pain Differential Diagnosis*
- *Acute Coronary Syndromes*
- *Acute Coronary Syndrome/ Chest Pain Work-up*
- *ST-elevation Myocardial Infarction and Non-ST-elevation Myocardial Infarction*
- *Cardiac Enzymes and Unstable Angina*
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- *Heart Failure*
- *Care-based on Patient Presentation*
- *Heart Failure Optimization*
- *Heart Failure: Goals of Treatment*

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MURMURS

Normal heart sounds:

- S1: Best heard at apex
- S2: Best heard at 2nd intercostal space
- Aortic component is best heard at the right upper sternal border
- Pulmonary component is best heard at the left upper sternal border
- S2 split during inspiration: Normal physiologic response
- S3: Due to ventricular filling, is in early diastole. Normal in children → disappears
- S4: Always abnormal, comes at late part of diastole.

At the left upper sternal border:

- Systolic murmur is pulmonary stenosis
- Diastolic murmur is pulmonary regurgitation.

Innocent Murmurs

- Always associated with normal heart sounds
- Occur in systole (except for venous hum, which is continuous)

- Usually brief, peaking in the first half of systole
- Innocent murmurs are often well localized, along the left sternal border
- The murmur's intensity often changes with position
- Cyanosis should never accompany an innocent murmur
- It is unusual for the grade of an innocent murmur to be greater than 3 (out of 6)
- The quality is often vibratory and musical, or sometimes blowing (never harsh).

CODE BLUE

- Remember CAB (circulation, airway, breathing) and never stop chest compressions except to shock
- What is the rhythm? Get the electrocardiogram (ECG), perform full set of labs. Use advanced cardiac life support (ACLS) cards!
- Is the rhythm: New/old? Symptomatic/asymptomatic?
- Vfib (ventricular fibrillation)/pulseless Vtach (ventricular tachycardia)
  - Shock (defibrillation) on 150J
- Pulseless electrical activity (PEA) or asystole
  - Epinephrine 1 mg IVP (intravenous push) every 3–5 minutes
  - Reversible Etiologies of Arrest (Hs and Ts):
    - Hypovolemia (give intravenous fluids),
    - Hypoxemia (give oxygen)
    - Hydrogen ion (acidosis); consider giving bicarbonate
    - Hypokalemia
    - Hyperkalemia (can give calcium gluconate, IV fluid, albuterol, Lasix and Kayexelate)
    - Hypothermia (warm blankets)
    - Toxins/Tablets (overdose—give the antidotes)
    - Tamponade (treat with pericardiocentesis)
    - Tension pneumothorax (treat with needle decompression)
    - Thrombosis cardiac or pulmonary (consider giving thrombolytics)
- *Bradycardia <40 bpm*: Symptomatic (light headed, shortness of breath, chest pain)
  - Atropine 0.5 mg every 3–5 minutes (max 3 mg) then transcutaneous pacer and transfer to intensive care unit (ICU)

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- Stop all beta blockers, calcium channel blockers, alpha blockers; including clonidine, glaucoma eye drops
- If patient is in asymptomatic bradycardia, stop all possible causative meds and wait.

TACHYCARDIA

- *Initial assessment*: Is the patient symptomatic? Stable or unstable?
  - Assess mental status, shortness of breath, chest pain, and hypoxia
- Feel the pulse, 12 lead ECG, vitals (especially blood pressure) and IV access
- Regular pulse >110 bpm and QRS <120 msec (narrow complex)
  - Unstable and heart rate (HR) >150 bpm
    - Crash Cart, ACLS, call for backup, synchronized cardioversion at 150J
  - *Stable (SVT with pulse)*: Call senior to consider these meds
    - Adenosine 6 mg (lasts 5–10 minutes), with ability to repeat a 12 mg dose if needed. Slows rate to identify rhythm
    - Cardizem 5–10 mg IV push × 1
  - If suspect WPW
    - No vagal maneuvers
    - Beware adenosine in Wolf-Parkinson-White (WPW) syndrome, chronic obstructive pulmonary disease (COPD)/asthma/bronchospasm
- Sinus tachycardia
  - Regular, narrow complex, HR 100–150, treat rate and cause
  - *Causes:*
    - *Dehydration (no urine, elevated creatinine)*: Treat with IV fluids
    - *COPD/asthma*: Nebulized atrovent q8hr (avoid albuterol as it can worsen tachycardia parenthesis)
    - *Pain*: Treat with morphine or dilaudid
    - *Fever with infection*: Treat with tylenol and antibiotics
    - *Anemia*: Assess and treat any acute hemoglobin change
    - *Hypovolemia*: Treat any acute blood loss
    - *Anxiety*: Consider anxiolytics if above organic causes ruled out

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- Medications for rate control
- Be aware of systolic blood pressure (SBP)
- SBP 100 to 120:
  - *B-Blocker* Initial:
    - Metoprolol 5 mg IVP q5 min × 3 doses or prn metoprolol 5 mg IV q6 hr
    - *Maintenance*: Metoprolol tartrate 25 mg po BID (max 200 mg BID) or metoprolol succinate (Toprol XL 400 mg daily)
- SBP >120:
  - *Ca^{2+} Blockers* Initial and prn:
    - Diltiazem 10 mg IVP q6 hrs
    - *Maintenance*: Diltiazem 30 mg PO q6 hrs (give IV and PO at same time as IV wears off quickly) and increase dose as BP tolerates (max 360 mg/day)

NARROW COMPLEX TACHYCARDIA

- Narrow complex tachycardia = supraventricular tachycardia (SVT)
  - HR >150 and QRS <120 milliseconds
- *Regular rhythm types*: Atrial and AV Junctional
  - Atrial:
    - Atrial flutter with regular block (150, 100, 75)
    - Atrial fibrillation (may appear as regular rhythm if rapidly conducting)
  - AV junctional
    - (AVNRT) AV nodal reentry tachycardia
    - *(AVRT) Atrioventricular reciprocating tachycardia*: Includes Wolff- Parkinson-White (WPW)
  - *Automaticity*: Atrial tachycardia (enhanced automaticity or ectopic atrial pacemaker)
  - *Irregular rhythm types*: Atrial fibrillation, multifocal atrial tachycardia (MAT)
- Wolff-Parkinson-White (WPW) syndrome
  - Caution with AV nodal agents and vagal stimulation
    - AV nodal blocking agents can speed up the bypass tract can stimulate the bypass tract
    - Can degenerate to VT/VF
    - Obtain old ECG to look for pre-excitation, discuss with cardiology.

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- AVNRT/AVRT:
  - Adenosine (avoid with AVRT like WPW)
  - Beta blockers or calcium channel blockers
- Atrial tachycardia:
  - Treat underlying disease process (e.g. COPD exacerbation/hypoxia)
  - Beta blockers or calcium channel blockers
  - Adenosine will not terminate the rhythm
  - ECG may show continued atrial beats without AV conduction, helping with the diagnosis
- *General principle:* Common theme in all types of Supraventricular tachycardia
  - Vagal maneuvers, adenosine, beta blockers, calcium channel blockers
  - Always use caution in Wolff-Parkinson-White
  - Check vitals (especially BP) frequently during acute setting. Call for backup!

ATRIAL FIBRILLATION

- Ensure the patient is stable, check ABCs
  - *Unstable*: Mental change, hypotension-> call a code, urgent cardioversion
  - Synchronized cardioversion to prevent "R-on-T" (induces Vfib)
- *Stable*: Review history, ECG, check labs (electrolytes: Ca, Mg, K), cardiac enzymes, echo (TEE may see thrombi), chest X-ray, medically manage

  If new onset rule out coronary artery disease (CAD) and hyperthyroidism
- *Medical management*: Rate control with a goal heart rate of 80–110
  - *SBP 90–110*: Digoxin load: 0.5 mg IV → 6 hrs later; 0.25 mg IV → 6 hrs later; 0.25 mg IV; Maintenance: 0.125 mg daily (in renal impairment cut doses in half)
  - *SBP 100–120*: B-blocker Initial: metoprolol 5 mg IVP q5 min × 3 doses OR prn metoprolol 5 mg IV q6 hr. Maintenance: Metoprolol 25 mg po BID (max 200 mg BID)
  - *SBP >120*: Ca^{2+} Blockers Initial and prn: Diltiazem 10 mg IVP q6 hours, Maintenance: Diltiazem 30 mg PO q6 hours (give IV and PO at same time as IV wears off quickly)

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- If rate control not managing rate or symptoms consult cardiology (they might use amiodarone, ibutilide, dofetilide, sotalol, flecainide, propafenone, procainamide)
- Once rate controlled convert if <48 hrs from onset. If >48 hrs anticoagulate first.
- *CHA_2DS_2-VASc criteria*: Determine need to anticoagulation for stroke prevention or not.
  - One point each:
    - CHF
    - HTN
    - Age 65–74 years
    - Female gender
    - Diabetes mellitus
    - Vascular disease history
  - Two points each:
    - Age >75 years
    - Stroke/TIA/Thromboembolism history.

      If the point total is 0 = give ASA 81–325; 1 = give ASA or warfarin; 2 = give warfarin

      Consider giving NOAC (novel anticoagulants) such as aspixaban or rivaroxaban if renal function allows (less bleeding risk than warfarin)

CHEST PAIN DIFFERENTIAL DIAGNOSIS

- *Life-threatening causes*: Acute MI; pulmonary embolus; pericarditis with tamponade; tension pneumothorax; aortic dissection; Boerhaave's syndrome; severe pneumonia, perforated ulcer
  - *Other common causes*: Costochondritis, GERD, herpes zoster, panic attack
  - *See and evaluate the patient*: Remember three important questions about chest pain: Duration? Location? Aggravating or relieving factors. If VS unstable: work-up for myocardial infarction (MI)
    - ECG, chest radiography and serial troponins
    - *Consider*: Arterial blood gas (ABG), d-dimer, spiral CT/CTA, lower extremity Doppler ultrasound, (contrast CT/TEE-if considering dissection)

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- Cardiology consult if troponins increasing or significant ECG changes (call senior)
- *Initial medications*: Oxygen, nitro, ASA 325, beta blocker, statin, ACE-inhibitor, heparin or G2b3a inhibitor, consider nitro-drip if chest pain unresolved
- Concern for PE–CT angiogram, consider heparin
- Concern for dissection—labetalol or nitroprusside, check BP in both arms/legs
- Concern for pneumothorax—needle decompression/chest tube
- Concern for pneumonia—chest X-ray, check bilateral breath sounds
- GI cause—give maalox, H2 (histamine) blockers, proton pump inhibitors (PPI's).

ACUTE CORONARY SYNDROMES

Symptoms related to obstruction of coronary arteries with chest pain being the most common symptom in addition to nausea, vomiting, diaphoresis, etc.

- Chest pain concerning for ACS is often radiating to the left arm or angle of the jaw, pressure-like in character, and associated with nausea and sweating.
- Classification criteria:
  1. Substernal chest pain
  2. Provoked by exertion or emotional stress, relief by nitroglycerin or rest
  3. Duration <30 minutest typically 3–5 minutes.
- Chest pain risk stratification:
  1. Typical or cardiac chest pain 3/3 criteria
  2. Atypical chest pain 2/3 criteria
  3. Noncardiac chest pain 1/3 criteria.

ACS—broken into three classifications: unstable angina, STEMI, NSTEMI

1. *Unstable angina*: Pain at rest or with minimal activity; pain prolonged usually more than 10 minutes or more severe than normal; pain occurring with increased frequency (differs from angina—induced by exertion, relieved in 3–5 min by rest or sublingual nitroglycerin)

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2. *STEMI*: ST segment elevation, elevated cardiac enzymes
3. *NSTEMI*: Possible ST depression, T-wave inversion, elevated cardiac enzymes.

Decision to admit based on HPI, radiation, duration and risk factors:

- *Absolute risk factors*: Family history of HTN, diabetes, smoking, elevated cholesterol, previous MI or CAD, pain is similar to previous episodes of cardiac ischemia
- *Contributory risk factors*: Age >30, male, obesity, sedentary, cocaine + ETOH
- Acute MI probability >20% admit to a CCU
- Lower risk—admit to telemetry
- GRACE score and TIMI score.

ACUTE CORONARY SYNDROME/CHEST PAIN WORK-UP

Without compelling evidence for a noncardiac cause, there is no way to exclude MI at presentation, so give all chest pain patients ACS/MI work-up and observe over time

- Give everyone nitroglycerin (NTG) 0.4 mg sublingual
  - Response does not predict cardiac source, but may give the patient relief
- ECG, troponin
- *STEMI*: >1 mm in 2 contiguous leads OR presumed new left bundle branch block
  - *Activate the STEMI code*: Call cardiology, telemetry, give IV fluid, O_2, Aspirin 325 mg x1, beta blocker, and nitro (up to 3 doses in 5 min)
  - ST elevation in II, III, avF: Do not give nitrate—concern for RV infarction (need preload)
- NSTEMI and unstable angina with ECG changes suggesting ischemia with high-risk:
  - ST-depression >0.5 mm OR inverted T wave with pain OR ST elevation >0.5 mm <20 min
  - ASA, nitro, oxygen (only if O_2 saturation <90% or signs of hypoxemia).
    Goal: Free of chest pain. If 3 doses of nitro and morphine did not relieve chest pain, or with suspicious ECG findings, notify the CCU resident

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- Be sure to notify senior resident or attending before you decide to give heparin or lovenox, and call the CCU resident/attending.

ECG normal or nonspecific changes with intermediate or low risk:

- Telemetry, rule out ACS with serial troponins, perform ECG, and consider predischarge stress test
- If no response to NTG × 3 and ECG is negative, can try maalox (antacid) or GI cocktail to treat dyspepsia.

ST-ELEVATION MYOCARDIAL INFARCTION AND NON-ST-ELEVATION MYOCARDIAL INFARCTION

ST-elevation Myocardial Infarction

- ST elevation, elevated cardiac enzymes
  - May see Q waves, ST elevations, hyperacute T waves or T wave inversions
  - Clinically significant ST segment elevations:
    - More than 1 mm (0.1 mV) in at least two anatomical contiguous leads
    - Or 2 mm (0.2 mV) in two contiguous precordial leads (V2 and V3)
  - *Note:* LBBB and pacemakers can interfere with diagnosis of MI on ECG
  - Remember 50% of patients with history of LBBB do not present with chest pain, and they have difficult ECG interpretation. Physician should have a low threshold to consider an acute MI in these patients.

Non-ST-elevation Myocardial Infarction

- ST depression, T-wave inversion, elevated cardiac enzymes
  - ST depressions (>0.5 mm) or T-wave inversions (>1.0 mm) without Q waves in 2 contiguous leads with prominent R wave or R/S ratio >1
  - *Isolated T-wave inversions*: Can correlate with increased risk for MI

    May represent Wellens' syndrome:
    - Critical left anterior descending (LAD) stenosis
    - >2 mm inversions in anterior precordial leads.

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CARDIAC ENZYMES AND UNSTABLE ANGINA

Unstable Angina

Nonspecific ECG changes, normal cardiac enzymes:

- Occurs at rest and prolonged, usually lasting >20 minutes
- New onset angina that limits activity
- *Increasing angina*: Pain that occurs more frequently, lasts longer periods or is increasingly limiting the patient's activity
- May present with nonspecific or transient ST segment depressions or elevations.

Cardiac Enzymes

Serial troponin: Have low sensitivities in the diagnosis of MI when measured within 6 hours of symptom onset:

- Should be measured at presentation and 6 hours later
- If negative at both times, with a normal or nondiagnostic ECG, there is a low risk for further complications
- Normal levels cannot exclude unstable angina
- Troponin is used for diagnosing MI because it is sensitive and specific
- CK-MB is more useful in postreperfusion MI or if troponin test is not available
- Other conditions can cause elevation in troponin such as renal failure or heart failure. The increasing troponin trend is the important thing to look for in diagnosing MI.
- Order troponin together with ECG when doing serial testing to rule out ACS.

AORTIC DISSECTION

- *Definition*: A tear in the inner layer of the aortic wall, which allows blood to enter into the wall of the aorta, creating the 'false lumen.'
- *Signs*: Sudden onset of sharp/tearing chest pain; neurological symptoms; extremity coolness
  - *Risk factors*: 1000 fold-less prevalent than MI; 80% of patients are hypertensive males
  - 50–70 years old with left ventricular hypertrophy
  - 70% of patients may have Marfan's, coarctation, aortitis, atherosclerosis, pregnancy, syphilis and/or history of trauma

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- *May see on physical exam*: Hypotension (dissection of ascending aorta), new murmur, pulse/BP differential, pulse deficit, stroke, widened mediastinum.

SPONTANEOUS PNEUMOTHORAX

- *Signs*: Sudden onset chest pain and shortness of breath, decreased breath sounds, tympanic to percussion, Marfanoid features, smoker
- 'Tall, thin smoking male'
  - Diagnose with chest X-ray
  - Treat with needle decompression.

GASTROINTESTINAL CAUSES OF CHEST PAIN

- *Differential diagnosis*: Boerhaave's syndrome, Mallory-Weiss tear, reflux, esophageal spasm, achalasia, ruptured peptic ulcer
- *Signs pointing toward a GI cause*: Pain related to food intake (within 15 min to 1 hr), related to a specific type of food, burning, belching
- *Signs of esophageal pain*: Sensitivity to gastric acid, motility disorders
- *Treatment for GI causes*: GI cocktail or nasogastric tube
- *Boerhaave's syndrome*: Ruptured esophagus caused by sudden vagal maneuver against closed glottis
- *Signs*: Chest pain, shortness of breath, hypotension, fever, left sided effusion, air under diaphragm
- Mackler triad
  - Vomiting, lower thoracic pain, subcutaneous emphysema.

MUSCULOSKELETAL CAUSES OF CHEST PAIN

Signs: Lasts seconds to hours, may be positional, chest wall tenderness to palpation, may have a specific cause, precordial catch syndrome.

ACQUIRED HEART DISEASE

- *Myocarditis*
  - Follows viral infection (such as CMV or Coxackie B). CHF may develop rapidly or insidiously.
  - Immunosuppressive drugs (steroids, azathioprine, cyclosporine) may improve recovery
- *Cardiomyopathy*
  - Questionable etiology

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  - No specific treatment
  - Progresses to congestive heart failure (CHF)
- *Infective endocarditis*
  - Presence of structural cardiac abnormalities predisposes to seeding of bacteria into endothelial erosions
  - *Most common organisms*: Strep viridans + *Staphylococcus aureus*. Others: enterococci, *E. coli, Candida albicans*
  - *Symptoms*: fever + anorexia + weight loss. Signs: petechial hemorrhage + splinter hemorrhage + splenomegaly + finger clubbing
  - *Diagnosis*: CBC + ESR + multiple blood cultures; perform echocardiogram
  - *Treatment*: IV antibiotics for 6 weeks
  - *Prophylaxis*: When bacteremia is likely to result from surgical/dental procedures: Start 1–2 days prior to dental procedure until 12–24 hours after procedure.

HEART FAILURE

- *Diagnosis*: Use physical exam and ancillary tests
  - *Signs*: Dyspnea, fatigue, cardiomegaly (displaced apical impulse), S3 (volume overload), orthopnea, PND, elevated jugular venous pressure (JVP), + abdominojugular reflux, pulmonary vascular congestion
  - *ECG, chest X-ray, Labs*: CBC, Na, K, BUN, Cr, glucose
  - *BNP*: <100 rules out HF, BNP>400 is consistent with CHF. Patients with afib, chronic CHF, pulmonary HTN, renal failure have higher baseline BNP. Obese patients have lower basal BNP
- *Inpatient monitoring:*
  - Daily weights, I/O, renal function and electrolytes (low Na, low K); frequent vital signs
  - Evaluate heart with 2D echo: LVEF, LV size, compliance, wall thickness and valve function
- *Heart failure classifications*: NYHA Class I-IV and ACC Stage A-D
  - NYHA Class I-IV (Functional Classification)
    - *Class I*: No symptoms or limitation in ordinary physical activity.
    - *Class II*: Mild symptoms (mild shortness of breath and/or angina) and slight limitation during ordinary activity.

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- Quick reference for commonly seen inpatient internal medicine, family medicine and intensive care unit (ICU) issues
- Addresses wide differential diagnoses concerns
- Includes sample notes to help providers and physicians in training to focus on the points that are important to address
- Assists in diagnostic work-up and initial management of internal medicine, family medicine and ICU patients.



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