Case 43: Dizziness

- **Chief complaint**
  - 56-year-old male presents with dizziness.

- **Vital signs**
  - HR: 80 BP: 110/60 RR: 14 Sat: 97% on RA T: 37.3°C Wt: 100 kg

- **Patient appearance**
  - The patient appears unwell, laying down in the cot. He looks fatigued and pale, and is noted to have diaphoretic skin.

- **Primary survey**
  - Airway: speaking normally
  - Breathing: no respiratory distress, clear lungs
  - Circulation: cool, clammy skin, 1+ distal pulses equally, capillary refill 3 seconds

- **Action**
  - Place patient on the monitor
  - Two large bore peripheral IV lines
  - Consider 1 L IVF bolus
  - POC glucose (74, if ordered)
  - Order Stat ECG

- **History**
  - Source: Patient, arrived by private vehicle
  - HPI: a 56-year-old male presents with dizziness since this morning. When walking into the bathroom, he felt lightheaded to the point that he almost lost consciousness and vomited (non-bloody, non-bilious). He endorses generalized weakness, mild shortness of breath, and is feeling very lightheaded. He has had some epigastric pain since vomiting this morning, which he describes as dull, constant aching that he rates as 7/10. The rest of his ROS is unremarkable.
  - PMHx: hypertension, Type 2 diabetes
  - PSHx: none
  - Allergies: none
  - Meds: can't remember the names, hasn't filled scripts in at least 6 months
  - Social: lives with wife, smokes 1 cigarette per day currently (20 pack-year history), occasional alcohol, no drugs
  - FHx: brother had a MI at 47

- Code Status: full code

- **Physical Exam**
  - **General:** awake and alert, appears unwell
  - HEENT: normal
  - Neck: normal
  - Chest: nontender
  - Heart: (must ask specifics) normal heart sounds
  - Lungs: normal
  - Abdomen: normal
  - Extremities: normal
  - Back: normal
  - Rectal: negative for melena or gross blood
  - Neuro: (must ask for complete neurologic examination) normal
  - **Skin:** cool, clammy
  - Lymph: normal
  - Psych: normal

- **Instructor Prompt:** learners should discuss differential diagnosis

- **Response/Results**
  - If ordered stat on arrival, ECG is now available for review
    - **Figure 43.1** - (they must interpret and act on the ECG themselves)
      - STE in III > II, reciprocal ST depression in I, aVL and V2, consistent with inferior STEMI likely due to RCA occlusion, plus likely associated RV infarction.
      - Intermittent 2nd degree block (Type II)

- **Action**
  - Order ECG, if not done already
    - After the learner reviews the ECG, they should immediately call STEMI activation (activate cath lab, cardiology consult).
  - Order Labs
    - CBC, BMP, LFT, troponin, BNP, PT/INR, PTT, type and screen
    - Consider lipase, lactic acid
  - Order ECG with right-sided leads
    - As time allows, discuss placement of R-sided leads (V1 and V2 in standard position, V3-6 placed on R-side of chest as mirror image to typical L-sided leads)
  - Order Imaging
    - Stat portable CXR
  - Order Meds
    - 1 L NS bolus
    - Aspirin chewable (325mg)

        - Consider fentanyl for pain (1 mg/kg).
        - Avoid morphine and nitroglycerin.
            - Discuss pre-load dependency of RV infarctions now or after the case is completed.
    - Consult cardiology
        - If time permits, have the learner have a discussion with a cardiologist who does not want to come in for PCI.
    - Consider POCUS Echo- will show reduced RV and septal wall motion which will further compel cardiology to take the patient promptly for PCI

- **Response/Results**
    - Patient reevaluation and repeat vitals:
        - Patient still has dizziness as well as epigastric pain
        - Vitals after 1 L NS bolus: HR: 70 BP: 120/68
        - Vitals if 1 L NS bolus not given: HR: 70 **BP: 93/55** (Prompt: give fluid bolus)
        - If nitroglycerin or morphine are given:
            - BP: **68/34** HR: 70 **RR: 22** Sat: 95%, distended neck veins
            - For evolving cardiogenic shock, the learner must give IVF and vasopressors (norepinephrine or dobutamine). If these steps are not taken promptly, the patient will develop cardiac arrest and require ACLS for resuscitation.
    - **Case 43 Lab Results** (sig for **Cr 1.2**; labs otherwise normal)
    - Additional Lab Results: **high sensitivity troponin 140 ng/mL, BNP 400**
    - Right-sided ECG (**Figure 43.2**)
        - Evolution of inferior STEMI with dynamic increase in height of ST segments
        - V4R shows loss of R-wave height, significant ST elevation (> 0.5mm; ST segment > R wave) and hyperacute T wave (very large T wave given amplitude of QRS complex) – this confirms the diagnosis of RV MI
    - CXR (**Figure 43.3**: normal)

- **Instructor Prompt:** request that the learner interpret the ECG and explain the diagnosis to the patient

- **Action**
    - Update patient of presumed diagnosis and plan
    - Disposition to Cath Lab with admission to cardiology on telemetry post-cath

- **Diagnosis**
    - Primary Diagnosis: Inferior wall myocardial infarction with right ventricular involvement

- **Critical actions**
    - Prompt ECG
    - IV access and fluid bolus

- Aspirin
- Avoid nitroglycerin or morphine administration
- Cardiology consultation / Activating cardiac catheterization lab

- **Instructor Guide**
  - This is a case of an inferior wall myocardial infarction (MI) with right ventricular involvement. The patient's atypical symptoms may be confused with an intra-abdominal process; but given the patient's history of HTN and DM, the learner must maintain a high suspicion for ACS. The patient has a relative hypotension (baseline HTN and non-compliant with medication) on arrival, thus IVF should be considered early. If the patient is given nitroglycerin or morphine, they will become hypotensive and may ultimately require pressors. Once STEMI is noted on the ECG the learner should immediately activate the cath lab and provide aspirin, while continuing to avoid agents that will drop the preload. A right-sided ECG and POCUS will confirm the diagnosis and further convince cardiology to take the patient for PCI.

- **Case Teaching Points**
  - The differential for this dizzy patient with vomiting, epigastric pain and SOB is broad but should include sepsis, dehydration, pancreatitis, GERD, acute cholecystitis, GI bleed, SBO, aortic dissection, aortic aneurysm, ACS, myocarditis, and CHF.

- **What constitutes Acute Coronary Syndromes (ACS)?**
  - Guidelines for ACS diagnosis and management are constantly under debate and evolving
  - ST Elevation Myocardial Infarction (see below)
  - Non-ST Elevation Myocardial Infarction
    - Not clearly meeting STEMI criteria but concerning symptoms and elevated troponin
    - Start with "medical management" including ASA, heparin, antiplatelet agents
    - 25% of "NSTEMI" patients have fully occluded lesions
    - Reperfusion therapy is indicated for ongoing ischemia, electrical or hemodynamic instability or progressive acute heart failure
  - Unstable Angina
    - New angina, atypical angina or pain similar to prior ischemia but without significant troponin elevation
    - Treat like NSTEMI

- **How do you avoid missing ACS?**
  - Maintain a high index of suspicion for ACS in all patients with chest pain, SOB, upper abdominal pain or ANY vague symptoms in high-risk populations who might present atypically (elderly, women, diabetes).
  - Stat ECG is essential for any patient in which ACS is on the differential. If the initial ECG is not diagnostic, serial ECGs to evaluation for dynamic changes are imperative (every 15-20 minutes).

- When in doubt consult cardiology; don't let pride or anticipated pushback prevent you from acting in the best interest of your patient.

- **Myocardial Infarction Overview**
  - What are potential ECG changes in a MI?
    - **Early:** hyperacute T waves (broad based, symmetrical, usually increased amplitude), giant R waves
    - **General:**
      - STE > 2.5 mm for men < 40 yrs, > 2 mm for men > 40 yrs, > 1.5 mm for women in V2-3, STE > 1 mm in 2+ other leads, STD V1-3 (posterior MI), old LBBB + Sgarbossa
      - ST depression (ischemia vs reciprocal) > 1 mm
    - **Late:** Q waves (1 small square wide, ¼ height of R wave), inverted T waves
  - What are different anatomical MIs and what will their ECGs show?
    - **Anterior Wall:** STE V1-4, I, aVL; STD II, III, aVF; occlusion of Left Anterior Descending (LAD); may affect LV, septum +/- conduction
    - **Lateral Wall:** STE I, aVL, V5-6; STD V1, V3R, V4R; occlusion of LAD or Left Circumflex (LCx); may affect LV
    - **Inferior Wall:** STE II, III, aVF; STD V1-4, I, aVL; occlusion of Posterior Descending (RCA > LCx); may affect AV node
    - **Right Ventricular:** STE III > II, V1 > V2, V3R, V4R; STD V2; occlusion of proximal RCA
    - **Posterior Wall:** STE V7-9 (posterior leads, 0.5mm); STD and tall R waves V1-3; occlusion of Posterior Descending (RCA > LCx); may affect RV, septum
  - What is the general ED Management of an MI?
    - **General:**
      - IV, O2 for hypoxia, monitor, defibrillate arrhythmias PRN,
      - Give 325 mg ASA (25% mortality reduction), true allergy is the only CI
      - Nitrates in non-RV MI
      - PCI within 90 min (or 120 min of first medical contact) or thrombolytics (goal of door to needle time of 30 minutes) if PCI not available within this timeframe
    - **Discuss timing** with Cardiology or per institutional norms: heparin gtt, P2Y12 inhibitor (clopidogrel 600 mg)
    - **Save for later**: beta blocker, ACE-I, statin
    - **RV Infarct:** avoid nitrates, diuretics, morphine; give IVF and inotropes PRN
    - **tPA:**
      - Indicated for STEMI: STE > 2 mm for men, > 1.5 mm for women in V2-3, STE > 1 mm in 2+ other leads), STD V1-3 (posterior MI), old LBBB + Sgarbossa),
      - CP > 30 min but < 12hr, no PCI available in < 90 min
      - Absolute contraindications include prior brain bleed or mass, ischemic stroke or sig closed head trauma < 3 mo, brain or spine surgery < 2 mo,

possible dissection, active bleeding, bleeding disorder, and severely uncontrolled HTN (despite IV therapy).

- What are potential complications of MI?
  - Early (< 24 hr): arrhythmia (most common), shock 2/2 pump failure or valve dysfunction (valve rupture).
  - Late (> 24 hr): Thromboembolism, myocardial rupture, valve rupture, CHF, pericarditis, LV anurysm

- **How is the presentation and management of inferior MI unique?**
  - 30-50% of inferior wall MIs involve the right ventricle, which has been associated with higher mortality and complications, especially in the setting of arrhythmias (though prognosis is good with prompt and appropriate therapy).
  - All ECGs with inferior ST elevations should have right-sided leads obtained (V7–9, will show up in V4-6 on R-sided ECG) – elevation in these leads is highly suggestive of right coronary artery occlusion and right ventricular infarction.
  - The RCA most commonly supplies the SA node (less commonly L Circ), so if there is a RCA infarction, bradycardia and other conduction abnormalities can exist. The bradycardia can appear to be junctional in nature since the AV node may need to take over pacemaker function. Blocks are also common.
  - Any drugs that decrease preload – such as nitroglycerin, diuretics or morphine – should be avoided in inferior MI cases.
  - If a patient with inferior MI is hypotensive, several liters of IV fluids may be safely administered. Inotropic agents such as dobutamine, norepinephrine or milrinone may be required.

- **POCUS Pearls**
  - When performing an echo on a normal heart, you will note that all segments of the ventricular myocardial wall thicken and contract in systole.
  - In a patient with acute MI, you may see signs of regional wall motion abnormalities on the echo that correspond to the territory of myocardium supplied by the occluded coronary vessel.
  - Regional wall motion abnormalities will often appear as absent or reduced thickening of the wall in systole or a generally hypokinetic, akinetic, or aneurysmal segment of myocardium.
  - Keep in mind that you need to get multiple views of the heart (i.e. parasternal short, parasternal long, apical four chamber, and/or subxiphoid view) for a thorough investigation of the myocardial walls.

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  - **References:**

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- Image References
    - ECGs from Life in the Fast Lane: https://litfl.com/right-ventricular-infarction-ecg-library/
    - Chest x-ray from Radiopaedia.org https://radiopaedia.org/articles/chest-radiograph?lang=us

Case 43 Lab Results

Basic Metabolic Panel:

Na	138 mEq/L
K	4.0 mEq/L
Cl	104 mEq/L
CO_2	24 mEq/L
BUN	15 mg/dL
Cr	1.2 mg/dL
Gluc	86 mg/dL

Liver Function Panel:

AST	32 U/L
ALT	14 U/L
Alk Phos	90 U/L
T bili	1.1 mg/dL
D bili	0.3 mg/dL
Lipase	40 U/L
Albumin	4.0 g/dL

Complete Blood Count:

WBC	8.2 x 10^3/uL
Hb	14.1 g/dL
Hct	42.5%
Plt	285 x 10^3/uL

Urinalysis:

SG	1.018
pH	6.8
Prot	Neg
Gluc	Neg
Ketones	Neg
Bili	Neg
Blood	Neg
LE	Neg
Nitrite	Neg
Color	Yellow

Coagulation Panel:

PT	13.1 sec
INR	1.0
PTT	28 sec

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Figure 43.1- ECG

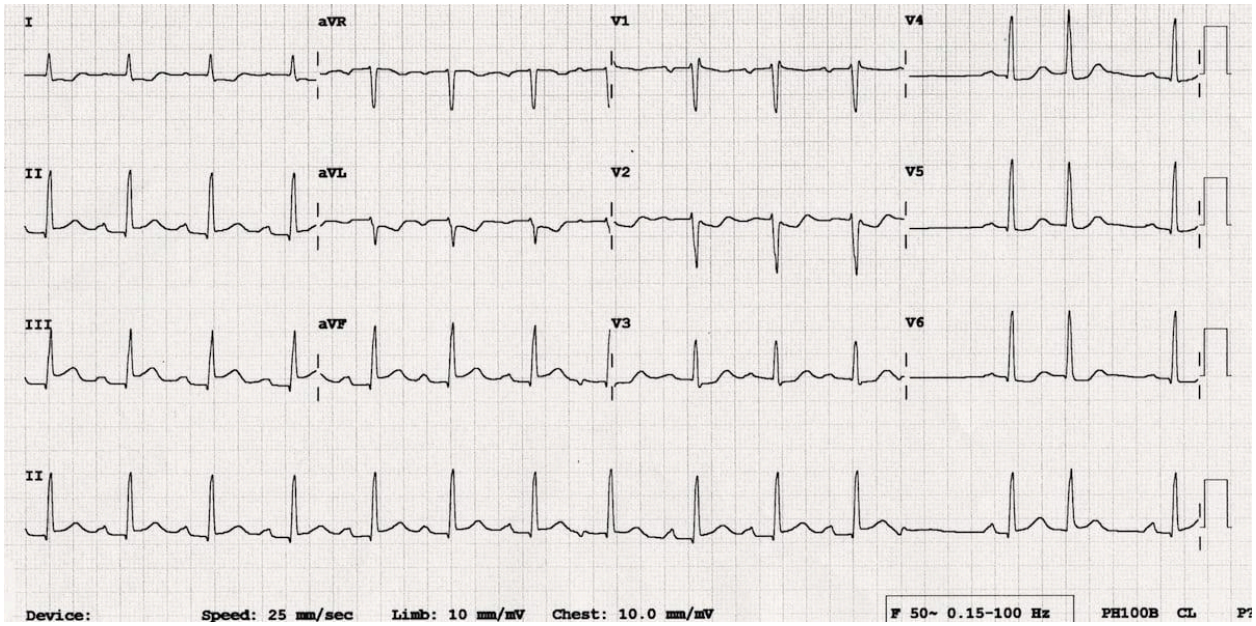

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Figure 43.2- Right-sided ECG

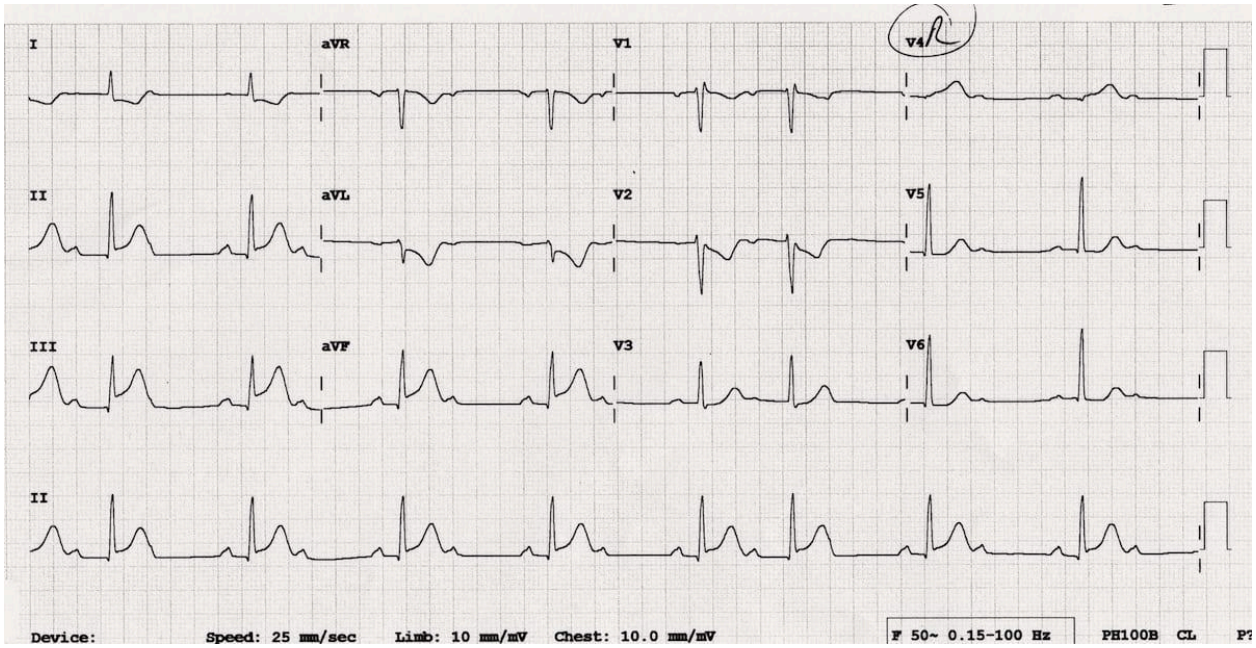

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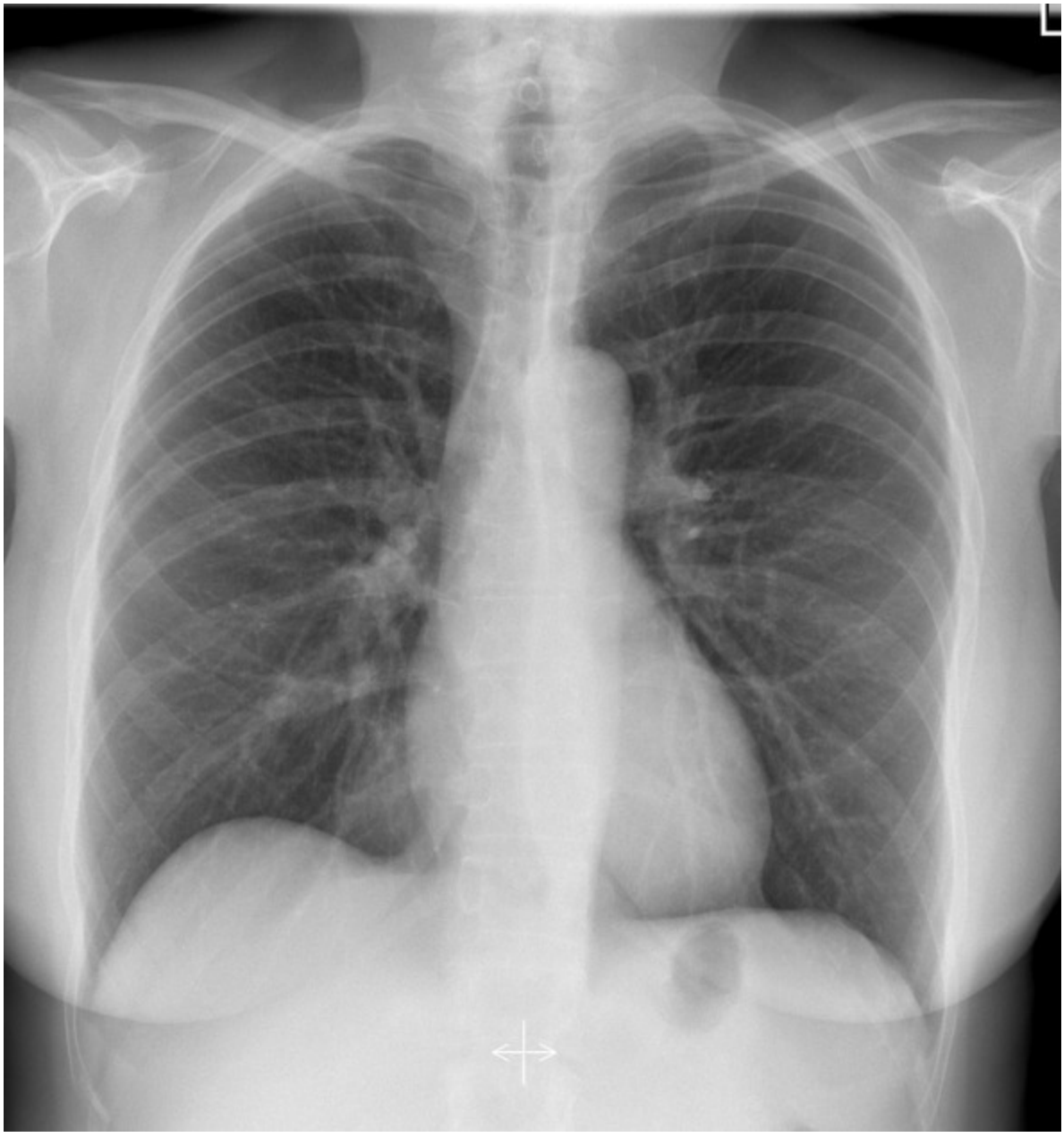
Figure 43.3- CXR



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