

Case report

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How to Approach a Patient with Chest Pain in Emergency Department



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Introduction

Chest pain is one of most common symptoms presenting in emergency department and it is worried us because it is widely range differential diagnosis between life threatening conditions such as Acute coronary symptoms (ACS), Pulmonary Embolism (PE), Aortic dissection, pericarditis with tamponade, pneumothorax and esophageal rupture or maybe the Chest pain can be caused by non-emergent conditions such as esophageal reflux, peptic ulcer, biliary colic, muscle strain, costochondritis, pleurisy, Pneumonia and non specific chest wall pain.

It is important as emergency physicians to have approach to chest pain to able recognized life-threatening conditions from non-emergent conditions and we will learn in this chapter how to approach to patient with Chest pain.

Currently we don't have data how many patients visiting ED in Middle East; however, in USA approximately 6 million patients visit ED almost 9% [1]. Which consider is second most common complain ED visit in USA.

General Approach to patient with Chest pain in Emergency Department as a general rule any chest pain is ischemic in origin until proven otherwise.

Initial approach

- A. Airway, Breathing and Circulation (ABC) assessment by
 - i. Assessment of the airway by able to talk without distress, no obvious upper airway obstruction such tongue swelling, lip swelling, hoarseness, ...etc.)
 - ii. Assessment of breathing (listen to the pulmonary sounds (Equal, wet (basal crackles indicate CHF).
 - iii. Assessment of Circulation (listen to heart sounds such as S3,4 gallop rhythm in congestive heart disease and new murmurs: mitral regurgitation murmur in papillary muscle dysfunction.

B. Vital signs should be assessed and repeated at regular intervals for example respiratory distress with low O₂ saturation indicate pulmonary edema, ↓BP indicates cardiogenic shock), also unequal BP in both arm or pulse deficient indicate aortic dissection.

Table 1: History of Chest Pain.

Type of Chest Pain	Pressure, Tightness, Or Heaviness, Sharp. Tearing or Ripping
Location	Central, Left, Or Right
Timing	Gradual Or Sudden Onset
Severity	Scale Of 0-10
Radiation	Back, Neck, Arm And Jaw
Provocations	What Makes Worse Or Better?
Associated Symptoms	SOB, Sweating, Nausea And Vomiting

C. Electrocardiogram (ECG): To interpret ECGs in myocardial ischemia and arrhythmias.

- D. Start with history.
 - i. What types of questions would you like to ask?
 - ii. Are you having discomfort?
 - iii. How would you describe the discomfort?
 - iv. Where is the discomfort?
 - v. Does it radiate anywhere?
 - vi. Any aggravating/alleviating factors?
 - vii. Any associated discomfort?
- E. Diaphoresis, nausea, vomiting, cough, fevers

- I. Frequency of the discomfort?
 - II. Time of onset or acute worsening?
 - III. Has there been any progression?
 - IV. History of Cardiopulmonary disease?
 - V. Risk factors for cardiopulmonary disease (Risk factor of coronary disease such as (HTN, Diabetes, High cholesterol, Obesity, Male, Family history, Smoker, Sedentary, Post-menopausal, Previous history of ACS and family History of CAD), Risk factors of Pulmonary embolism).
 - VI. Family history of cardiopulmonary disease? (Table 1).
- F. Start with physical examination
- i. General appearance of patient looks sick or not sick or patient in pain or not in pain.
 - ii. Assessment of the airway by able to talk without distress, no obvious upper airway obstruction such tongue swelling, lip swelling, hoarseness ...etc.)
 - iii. Assessment of breathing (listen to the pulmonary sounds (Equal, wet (basal crackles indicate CHF).

- iv. Assessment of Circulation (listen to heart sounds such as S3,4 gallop rhythm in congestive heart disease and new murmurs: mitral regurgitation murmur in papillary muscle dysfunction
- v. Look for swelling in legs (lower limb edema), calf tenderness (deep vein thrombosis).
- vi. Asses abdomen for tenderness and pulsating mass.

Case 1

46-year-old male with DM, HTN, Coronary Artery Disease 1 year ago and Smoker complain of chest tightness and heaviness gradual onset 3 hour ago lasting 20 minutes when he was watching TV the pain scale was 5/10, radiated to his jaw this pain associated with nausea and sweating, the pain relived by Nitro spray taken by himself but after he arrived to ED the pain started again with pain scale 10/10.

Initial assessment at triage

- a. ABC intact
- b. BP140/80 HR110 RR24 O2 sat 98% on 2 L O2 Temperature: 37.3 Random blood Sugar: normal
- c. ECG (Figure 1)

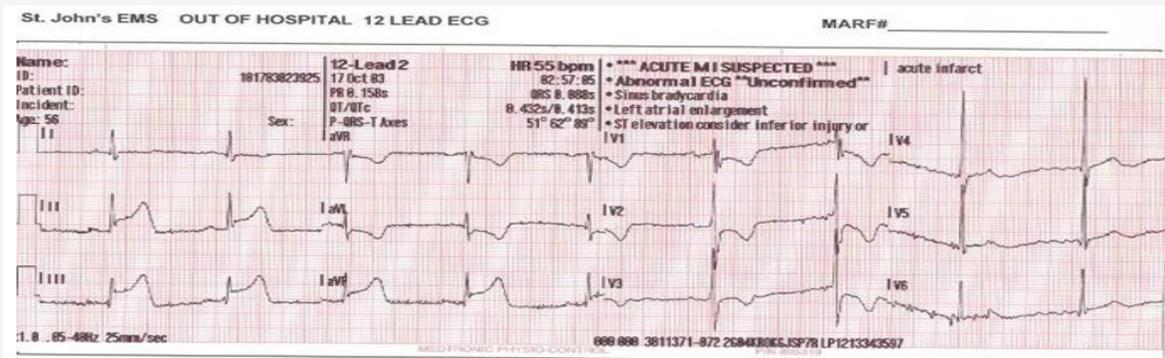


Figure 1

Critical bedside actions and general approach

- a. O₂ Supply and monitor bed.
- b. ABC intact.
- c. Vitally stable except he is tachycardia (HR 110).
- d. Quick history and Physical examination.
- e. To do 12 lead ECG shows inferior ST elevation Myocardial Infarction to consult cardiologist as soon as possible.
- f. Patient in Pain need analgesia.
- g. Aspirin 300mg was given by EMS.
- h. Quick exam shows.

- i. Chest exam: Equal air entry, no wheeze or crackles.
- j. CVS exam: S1+S2 no additional sound, no murmur, JVP was Normal.
- k. No lower limb edema, pulses for 4 limb present and equal.

Differential diagnoses

- a. Myocardial ischemia or infarction (MI).
- b. Pulmonary embolus (PE).
- c. Pneumothorax .
- d. Pericarditis with Tamponade.
- e. Aortic dissection.

- f. Esophageal rupture.

History and physical examination hints

- a. The chest Pain is Typical angina pain (Heaviness radiating to jaw associated with nausea and sweating), the pain is not sharpening such in PE or Tearing like in aortic dissection.
- b. The Patient has cardiac risk factors (DM, HTN, CAD, Smoker and MI 1 year ago).
- c. No PE risk factors.
- d. The history not suggested any history of Esophageal rupture.
- e. Physical exam not lead to cardiogenic shock or pulmonary edema.
- f. No sign of pneumothorax in exam.
- g. Pulses all equal for four limbs and no inequality in BP in both arm which not going with aortic dissection.
- h. ECG suggested Inferior MI, no sign of pericarditis in ECG.

Emergency diagnostic tests and interpretation

- a. ECG suggested Inferior MI, no sign of pericarditis in ECG.
- b. Portable CXR: normal which is role out pneumothorax and aortic dissection (no wide mediastinum).
- c. Troponin I is high which is suggested Myocardial ischemia.
- d. Bed side echocardiography there is hypokinetic in inferior wall and no sign of cardiac tamponade.

Bedside test

- a. 12 lead ECG for (Anterior, inferior and lateral myocardial infarction AND 15 lead ECG (posterior myocardial infarction) to detect any ST elevation in 2 contiguous leads: STEMI.
- b. Ischemic changes (ST depression, T inversion and Q wave), ECG is more useful as 'rule in' than 'rule out' ECG in Acute Myocardial Infarction 50% sensitivity, 90% specificity.

Laboratory tests

- a. Blood cardiac markers: Troponin I or T rise within 3-6H and then remain elevated for about one week.
- b. Serial testing, at least 6H after symptom onset improves sensitivity.
- c. In ACS an increased troponin is a marker for increased risk of AMI and death.
- d. Does NOT diagnose cardiac ischemia.

Imaging modalities

- a. Chest X- ray: To look for heart failure and evaluate for other cause of chest pain such as Aortic Dissection.

Emergency treatment

Aspirin should be given immediately: Great benefit, little risk, Give minimum of 182 mg.

Rapid decisions on reperfusion: Based on ECG only (PCI vs Fibrinolysis).

Antiplatelet options: Heparin (LMW v unfractionated) clopidogrel.

Symptomatic/pain control: GTN Vasodilator, also reduces preload Can give SL or IV and Morphine for pain control and reduce anxiety and stress.

Secondary prevention: B-Blocker, statins and ACE inhibitor.

Disposition decision

- a) Assess the risk stratification by using TIMI score (Figure 2 & 3).

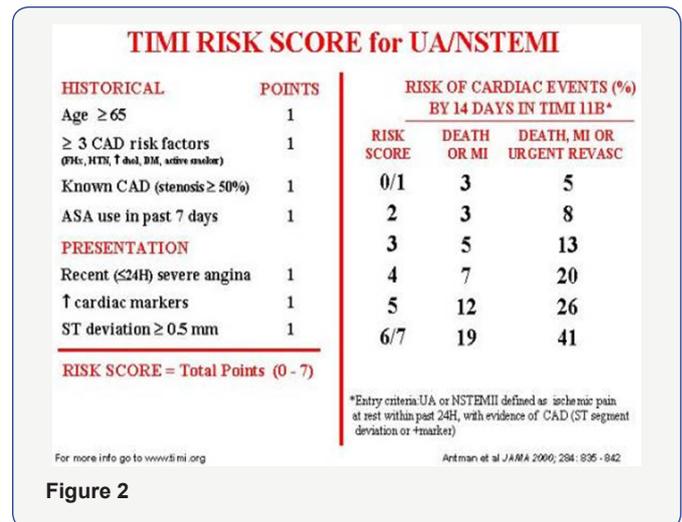


Figure 2

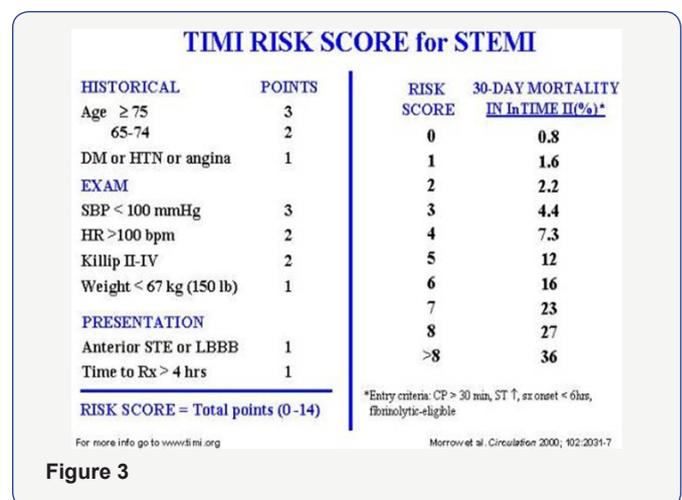


Figure 3

Admission criteria

- Establish risk level using the TIMI scoring system.
- Moderate risk: Admit for further evaluation, add beta blockers, ACE inhibitors. Follow cardiac enzyme levels. If MI ruled out, Exercise stress test before discharge.
- High Risk: Admit for cardiac catheterization.
- Discharge criteria.
- Low risk TIMI score: May be discharged after symptom control and follow up with cardiologist outpatient for stress test and lipid profile test.
- Referral: Cardiology to be consulted

Case 2

30-year-old male had an open reduction and internal fixation (ORIF) of right ankle fracture 2 weeks ago, c/o sudden onset of chest pain today this is pleuritic sharp chest pain associated with short breath increased during inspiration [2-5].

Initial assessment at triage

- ABC intact.
- Vital sign: BP 120/80 Pulse 120 RR 20 O2 sat 88% on room air T 36.5.
- 12 ECG shows: sinus tachycardia, T inversion V2,3 and 4, deep S lead 1 and Q and T inversion in lead 3, ST elevation V1 and V4R suggested pulmonary embolism. (Figure 4).

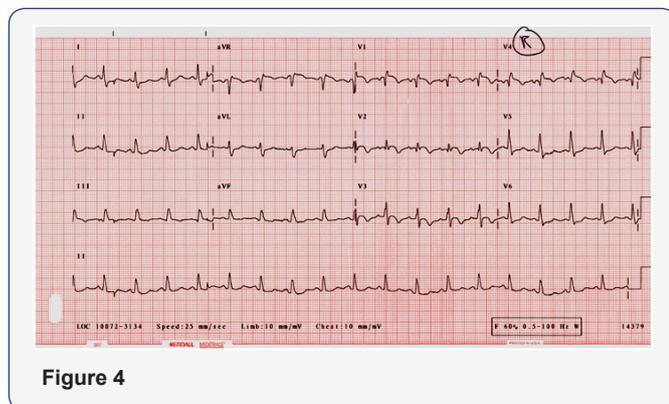


Figure 4

Critical bedside actions and general approach

- 2 Supply and monitor bed.
- ABC intact.
- Vitally stable except he is tachycardia (HR 120).
- Quick history which suggested that patient went major surgery 2 weeks ago and was immobilized 2 weeks and Physical examination shows.
- Chest exam: Equal air entry, no wheeze or crackles.
- CVS exam: S1+S2 no additional sound, no murmur, JVP was Normal.

- There is calf swelling in Right site of surgery, pulses for 4 limbs present and equal.
- To do 12 lead ECG shows sinus tachycardia, T inversion V2,3 and 4, deep S lead 1 and Q and T inversion in lead 3, ST elevation V1 and V4R suggested pulmonary embolism.
- Patient in Pain need analgesia.

Differential diagnoses

- Pulmonary embolus (PE).
- Myocardial ischemia or infarction (MI).
- Pneumothorax.
- Pericarditis with Tamponade.
- Aortic dissection.
- Esophageal rupture.

History and physical examination hints

- The chest Pain is atypical angina pain (sharp, pleuritic chest pain increased by inspiration and associated with short of breath, noradiation), the pain is not angina pain OR no tearing pain as in aortic dissection.
- There is PE risk factors (major surgery, immobilization 2 weeks).
- The history not suggested any history of Esophageal rupture.
- Physical exam not lead to pneumonia no crackles in chest exam.
- No sign of pneumothorax in exam.
- Pulses all equal for four limbs and no inequality in BP in both arm which not going with aortic dissection.
- ECG suggested PE, no sign of pericarditis in ECG.

Emergency diagnostic tests and interpretation

- ECG suggested Pulmonary embolism, no sign of pericarditis in ECG.
- Portable CXR: normal which is role out pneumothorax and aortic dissection (no wide mediastinum)
- D- Dimer is high.
- Cardiac enzymes are negative.
- Bed side echocardiography there is sign of Right ventricle enlargement and strain and no sign of cardiac temponade.

Bedside test

- 12 lead ECG for PE sign in ECG S1Q3T3 sign (prominent S wave in lead I, Q wave and inverted T wave in lead III) is a sign of acute corpulmonale (acute pressure and volume overload of the right ventricle because of pulmonary hypertension) and reflects right ventricular strain (2).

- b. Other ECG findings noted during the acute phase of a PE include new right bundle branch block (complete or incomplete), rightward shift of the QRS axis, ST-segment elevation in V1 and aVR, generalized low amplitude QRS complexes, atrial premature contractions, sinus tachycardia, atrial fibrillation/flutter, and T wave inversions in leads V1-V4 (3).
- c. The ECG is often abnormal in PE, but findings are neither sensitive nor specific for the diagnosis of PE. (4), The greatest utility of the ECG in a patient with suspected PE is ruling out other life-threatening diagnoses (e.g., acute myocardial infarction).

Laboratory tests

- a. D-dimer.
- b. Only use is in a low risk patient.
- c. A negative test makes PE very unlikely.
- d. A slightly positive test is a positive test.

Imaging modalities

- a. Chest X- ray: To look for heart failure and evaluate for other cause of chest pain such as Aortic Dissection.
- b. V/Q scan very sensitive but not specific.
- c. Spiral CT with contrast show large, central emboli.
- d. Pulmonary angiogram is gold standard but carries risk of contrast induced nephrotoxicity and anaphylactic contrast reaction.
- e. Consider Doppler U/S of legs to see deep vein thrombosis in legs.

Emergency treatment

- a. Heparin (Will limit propagation but does not dissolve clot)
 - i. Unfractionated: 80 u/kg bolus, 18 h/kg/hr.
 - ii. Fractionated (Lovenox): 1 mg/kg SC BID.
- b. Fibrinolysis
 - i. Consider with large if patient is unstable.
 - ii. No study has shown survival benefit, but very difficult to study.
 - iii. Alteplase 50–100 mg infused over 2–6 hrs., (bolus in severe shock).

Disposition

- a. If there is suspicious of PE, we need to do pre-test probability, there is Multiple systems for doing this.
- b. Most widespread and validated is Well's score.

- c. There is different in Well's score for PE & DVT.
- d. PE - Well's criteria.
- e. 3 points for:
 - i. PE 'most likely diagnosis'.
 - ii. Signs and symptoms suggesting DVT.
- f. 1.5 points for: PR>100, past History (PE/DVT), immobilization in 2 weeks.
- g. 1 point for: Hemoptysis or malignancy.
- h. <2 low risk (10%), D-Dimer is good to rule out PE.
- i. 2-6 medium risk (25%), Spiral CT chest with contrast to rule out PE.
- j. >6 high (50%), start anticoagulation (LWMH) and Spiral CT chest with contrast.

Referral

- a. ICU: Unstable Patient, massive PE, Bilateral PE.
- b. Medical Ward: Stable patient with Small PE.

Case 3

60 y old male patient presented to ED with sudden onset central chest pain, described as

ripping his chest and radiate to back, no associated symptoms and patient previous history with HTN, CAD and smoker.

Initial assessment by EMS

- a. ABC intact.
- b. BP 190/95 Right arm, Pulse 110 RR 20 T 37 O₂ sat 98%.
- c. On examination, the blood pressure is 185/85 mm Hg right arm BP 200/100 left arm, and the pulse rate is 110/min and regular.
- d. A grade 2/6 systolic murmur and a soft decrescendo diastolic murmur are heard at the second right intercostal space.
- e. There are abdominal and bilateral femoral bruits, with absent distal pulses.
- f. There radio-to radio pulsation delay.
- g. His EKG shows no ST, T wave changes.
- h. CXR is wide mediastinum no sign of pneumothorax or CHF

Critical bedside actions and general approach

- i. O₂ Supply and monitor bed.
- ii. ABC intact.

- iii. Vitrally stable except he is high BP185/85 mm Hg right arm BP 200/100 left arm, tachycardia (HR 110).
- iv. Quick history which suggested sudden onset central chest pain, described as ripping his chest and radiate to back, no associated symptoms and Physical examination shows
- v. Chest exam: Equal air entry, no wheeze or crackles.
- vi. CVS exam: S1+S2, a grade 2/6 systolic murmur and a soft decrescendo diastolic murmur are heard at the second right intercostal space., JVP was Normal.
- vii. There is there radio-to radio pulsation delay.
- viii. There are abdominal and bilateral femoral bruits, with absent distal pulses.
- ix. To do 12 lead ECG shows no ST, T wave changes, no sign of MI.
- x. Portable CXR shows wide mediastinum, no sign of CHF, pneumothorax or pneumonia.
- xi. Patient in Pain need analgesia (Figure 5).

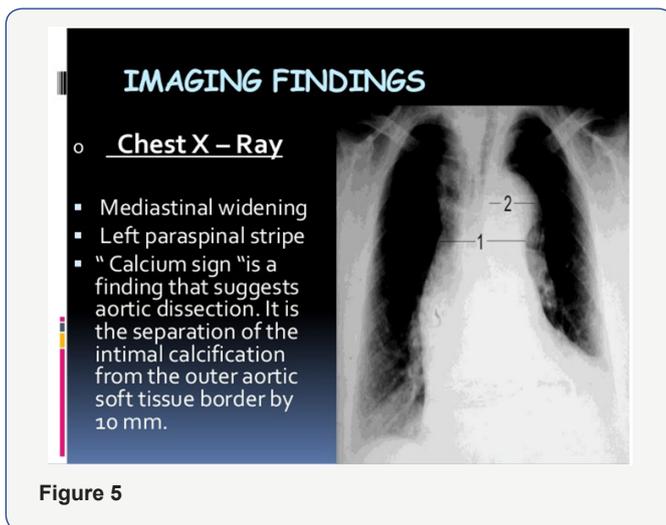


Figure 5

Differential diagnoses

- a. Aortic dissection.
- b. Myocardial ischemia or infarction (MI).
- c. Pulmonary embolus (PE).
- d. Pneumothorax.
- e. Pericarditis with Tamponade.
- f. Esophageal rupture.

History and physical examination hints

- a. The chest Pain is sudden onset central ripping chest pain radiating to back as in aortic dissection, the pain it is not angina pain.
- b. There is Risk factors, HTN, CAD, smoker and age.

- c. The history not suggested any history of Esophageal rupture.
- d. Physical exam not lead to pneumonia no crackles in chest exam.
- e. No sign of pneumothorax in exam.
- f. Pulses delay in radio –radio pulsation and different BP in both arm and abdominal and bilateral. femoral bruits, with absent distal pulses with going with aortic dissection.
- g. ECG no sign of ischemic changes, no sign of pericarditis in ECG.
- h. Patient in Pain need analgesia.

Emergency diagnostic tests and interpretation

- a. 12 lead ECG shows no ST, T wave changes, no sign of MI.
- b. Portable CXR shows wide mediastinum, no sign of CHF, pneumothorax or pneumonia.
- c. Cardiac enzyme was negative role out MI.
- d. D-Dimer was negative.
- e. Bed side Echo no sign of temponade.

Bedside test

- a. CXR- Widened mediastinum, abnormal aortic knob, pleural effusions.
- b. Not sensitive (25% have wide mediastinum's).
- c. Bedside US - evaluate aorta and look at heart to r/o tampanode.

Laboratory tests

- a. Laboratory tests to role out other differential diagnosis such as MI, PE.

Imaging modalities

- a. CXR- Widened mediastinum, abnormal aortic knob, pleural effusions
- b. Not sensitive (25% have wide mediastinum).
- c. Chest CT- Very sensitive and specific
 - i. Quickly obtained
 - ii. Must think about kidney + contrast
- d. Chest Angiography- Gold standard
- e. Most reliable anatomy of dissection

Emergency treatment and disposition

- a) Involve Cardiac Thoracic surgery early.
- b) Blood pressure control
 - i. Goal SBP 120-130 mmHg.
 - ii. Beta blockers are first line (Labetalol and Esmolol).

- iii. Can add vasodilators i.e. nitroprusside.
- c) Admission to ICU
- i. Ascending dissections will need surgery.
- ii. If dissection is only descending, management is only.

Case 4

55 alcoholic with persistent vomiting presents with sudden onset of Chest Pain followed by hematemesis. The chest pain sudden onset, sharp in nature radiating to back it is associated with short of breath for 3 hours past medical history DM, HTN, alcoholic and smoker.

Initial assessment

- a. ABC intact.
- b. BP 120/80 equal bilateral arm P 90 regular and equal 4 limbs no pulse deficit RR 40 T 38 O sat2 96% on room air.
- c. On examination there is decrease air entry in right side and there is subcutaneous emphysema in Right side of chest.

Critical bedside actions and general approach

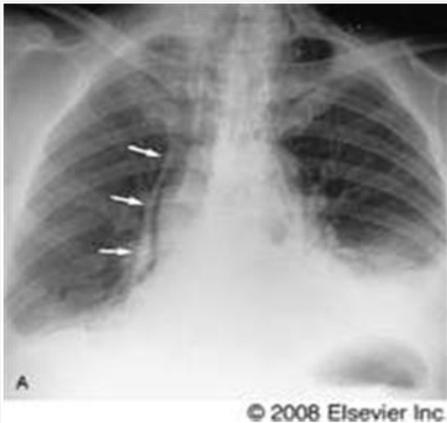


Figure 6

- a. O2 Supply and monitor bed.
- b. ABC intact.
- c. Vitality stable except he is febrile (T 38)
- d. Quick history which suggested sudden onset of Chest Pain followed by hematemesis. The chest pain sudden onset, sharp in nature radiating to back it is associated with short of breath for 3 hours
- e. Physical examination shows:
 - i. Chest exam: decrease air entry in left side, and there is subcutaneous emphysema in left side of chest.
 - f. CVS exam: S1+S2. no additional sound, JVP was Normal pulses equal in four limb To do 12 lead ECG shows no ST, T wave changes, or ischemic changes.

- g. Portable CXR shows left plural effusion and right pneumomediastinum and normal width of mediastinum. (Figure 6).

Differential diagnoses

- a. Esophageal rupture.
- b. Aortic dissection.
- c. Myocardial ischemia or infarction (MI).
- d. Pulmonary embolus (PE).
- e. Pneumothorax .
- f. Pericarditis with Tamponade.

History and physical examination hints

- a. The chest Pain is sudden onset of Chest Pain followed by hematemesis. The chest pain sudden onset, sharp in nature radiating to back it is associated with short of breath for 3 hours after history of repeated vomiting and associated with short of breath and vomiting blood (hematemesis).
- b. There is Risk factors, HTN, CAD, smoker and alcohol.
- c. There is strong history suggested of Esophageal rupture.
- d. Physical exam shows decrease air entry in left side, and there is subcutaneous emphysema in left side of chest.
- e. No sign of pneumothorax in exam.
- f. ECG no sign of ischemic changes, no sign of pericarditis in ECG.

Emergency diagnostic tests and interpretation

- a. 12 lead ECG shows no ST, T wave changes, no sign of MI.
- b. Portable CXR shows left plural effusion and right pneumomediastinum and normal width of mediastinum. No sign of pneumothorax, no sign of CHF, no sign of pneumonia.
- c. Cardiac enzyme was negative which rule out MI.
- d. D-Dimer was negative.
- e. Bed side Echo no sign of tamponade.

Bedside test

- a. 12 lead ECG to rule out MI, PE and pericarditis.
- b. CXR-To rule in the esophageal rupture sign in chest X-ray which are (Hydropneumothorax, Pneumothorax, Pneumomediastinum, Subcutaneous emphysema, Mediastinal widening without emphysema, Subdiaphragmatic air and Pleural effusion.
- c. Bedside US - evaluate aorta and look at heart to r/o tamponade.

Laboratory tests

- Laboratory tests to rule out other differential diagnosis such as MI, PE.
- Complete blood count, ESR, Creatinine, blood culture and lactate to rule out infection.

Imaging modalities

- CXR- Hydropneumothorax, Pneumothorax, Pneumomediastinum, Subcutaneous emphysema, Mediastinal widening without emphysema, Subdiaphragmatic air and Pleural effusion.
- Contrast-enhanced CT scan of the chest should be obtained if it is not possible to obtain a contrast esophagogram, if the esophagogram was negative despite a high clinical suspicion, or if seeking to evaluate for a more likely alternative diagnosis. Perforation may be suggested by mediastinal air, extravasated luminal contrast, periesophageal fluid collections, pleural effusions, or actual communication of an air-filled esophagus with an adjacent mediastinal air-fluid collection; definitive esophageal communication with outside structures is often difficult to visualize.

Emergency treatment and disposition

- Admission to a medical or surgical intensive care unit (ICU).
- Nothing by mouth.

- Parenteral nutritional support.
- Nasogastric suction - This should be maintained until there is evidence to indicate that the esophageal perforation has healed, is smaller, or is unchanged.
- Broad-spectrum antibiotics - No randomized clinical trials exist for antibiotics and esophageal perforation; however, empiric coverage for anaerobic and both gram-negative and gram-positive aerobes should be initiated when the initial diagnosis is suspected.
- Narcotic analgesics.

Outcome

- survival 65-90%.
- poor survival w/ delayed dx >48hrs.

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