
Chest Pain

Smoking tobacco increases the risks for CVD and the rates of hospitalisation with or death from ACS, cerebrovascular disease and peripheral arterial disease (Banks et.al, 2019).

Mr. X consumes four standard drinks a day and drinks every day. This is above the recommended limits for alcohol consumption in men, by Ministry of New Zealand (2019).

Mr X works in a local hospice shop, five days a week. He does not engage in any daily exercises. It is recommended that older adults engage in some sorts of moderate physical activity of 30 minutes daily for five or more days a week to maintain optimum health standards (Ministry of health, 2017). He sleeps up to nine hours each night which meets the recommendations of National sleep foundation (2015). Mr. X had a recent trip to California, last week. Mr X's partner recently died of cancer and declared that he is under a lot of stress recently which includes financial component as well. Recent emotional trauma and mental stress can provoke myocardial ischemia and other cardiovascular events (Ma et al., 2018)

Mr X's Bowel and bladder function are normal. There were no records of any allergies to drugs and food. Immunizations are up to date.

Past Medical history

Mr X suffers from hypertension and hyperlipidaemia. Metoprolol 23.75 and Atorvastatin 40 mg was prescribed to him by his physician. He stopped taking these medications for six months. Studies have shown that non-adherence to cardiovascular medications can result in therapeutic escalation, higher treatment costs and increase the risk for major cardiovascular events, including death (Kolandaivelu, et, al. 2014).

Past surgical history

Mr X had a history of Tonsillectomy in 2010.

Family History

Mr X lives with his nephew in their own apartment. His father had a history of hypertension and died at the age of 55 from heart attack. Mother had Deep Vein Thrombosis (DVT) and Hypertension.

Diagnostic Considerations

From the perspective of Mr X's presenting complaint, relevant history and appearance three potential diagnoses were made. These are Pulmonary Embolism (PE), Acute Coronary Syndrome (ACS) and Musculoskeletal chest pain.

Pulmonary Embolism was considered as a possible diagnosis. Mr X had a recent history of travel to California which has more than 10 hours onward flight duration. Prolonged travel, which

may include long hours of travel in car or aircraft, increases the risk of developing blood clots. These blood clots that originate in deep veins of the pelvis, thighs, legs and occasionally in arms, may get dislodged and travel through the bloodstream and lodge in the lung, causing PE (Bartholomew & Evans, 2019). Again, chest pain and shortness of breath are more frequently observed in patients with PE (Morrone & Morrone, 2018). Mr X presented to ED with chest pain and mild shortness of breath.

Another possible differential diagnosis is ACS. In most patients with ACS, chest pain is commonly seen as a presenting complaint. (Barstow et al., 2017). Mr X's chief complaint was chest pain. Patients with a chronic history of Hypertension, hyperlipidaemia and advanced age, are at higher risk for ACS, due to atherosclerosis. (Singh et al., 2019). Mr X is 64 years old, with a long-standing history of the above-mentioned risk factors.

Chest pain of Musculoskeletal origin has an estimate of the prevalence of 6.2% in Emergency departments (Winzenberg, et, al. 2015). Strenuous physical activities, that requires the use of muscles of the chest wall can lead to muscle soreness (Aroesty et al., 2018). Mr X was shifting to a new house this morning and reported that he had lifted household items. There is a chance that he has strained his chest muscle, which may have caused the chest pain.

Physical Examination

Vital signs

Vital signs were obtained at triage, which showed a temperature of 36 degree celsius, an oxygen saturation of 95 percentage, a respiratory rate of 24 breaths per minute, heart rate of 110 beats per minute and blood pressure of 195/125 mm hg. Evidences prove that High blood pressure is one of the important causative factors for cardiovascular disease with substantial prevalence of exposure (Fuchs & Whelton, 2020).

Review of Systems

General: Patient is alert, oriented. Mr X is well-groomed and maintained good hygiene. The patient looked highly anxious and frightened.

Head, Eyes, Ear, Nose and Throat: The Patient reported dizziness. He denied any headache and earache. No visual changes or blurred vision noted. Denies discharges from ear, nose and eyes. No problems with teeth and mouth.

Respiratory: Patient is mildly short of breath, with a respiratory rate of 24 breaths per minute. Dyspnoea is usually seen in patients with Myocardial infarction, Acute coronary syndromes and cardiogenic shock as result of low cardiac output (Berliner et al., 2016). No tracheal tug and use of accessory muscles noted. No intercostal, subcoastal and supra clavicular retractions. Trachea stayed midline. Resonant sound heard on percussion of anterior and posterior chest. Good air entry noted bilaterally. No adventitious breath sounds heard. No cough reported.

Cardiovascular system: Patient reported central chest pain, radiating to neck, jaw and back of the left shoulder. He scored 8 for the chest pain and described it as sharp and intense. He has also reported mild shortness of breath and dizziness. Chest pain or pain in other body parts

such as jaw, neck and shoulder, along with dizziness, breathlessness and sweating is evident in acute coronary syndrome. (Best Practice Journal, 2015)

Mr X was diaphoretic with cold, clammy and moist skin. Dizziness was also reported. Dizziness occurs as a result of cerebral hypoperfusion and is often associated with activation of the sympathetic nervous system which causes palpitation and diaphoresis. (Maja Susanto, 2014)

No central or peripheral cyanosis observed. No scars, oedema or varicose veins noted on bilateral limbs. Good hair distribution was noted bilaterally in the lower limbs. Patients with peripheral arterial disease in the lower extremities, would experience hair loss in lower limbs due to reduced blood flow, resulting from atherosclerosis (McDivitt et al., 2019). Capillary refill of 2 seconds noted. No splinter haemorrhage or clubbing of nailbeds noted. Palmar crease is slightly darker, bilaterally. Radial, brachial, popliteal, tibial and dorsalis pedis pulses were palpable and symmetric. Pulse was fast-paced.

Heart sounds were auscultated and a diminished S1 sound was heard. Weak ventricular contraction resulting from myocardial ischemia produces diminished S1 sound (Bickley et al., 2017).

Carotid arteries were palpated and auscultated and were normal.

Musculoskeletal system: Normal range of motion were observed. No stiffness reported. No change in severity of pain was reported on palpation of chest, shoulder and arms.

Differential Diagnoses

Three differential diagnoses were identified based on clinical examination on the patient. These are PE, ACS and Musculoskeletal chest pain.

Pulmonary embolism produces symptoms like chest pain of sudden onset, sharp in nature and sometimes worsens on inhaling and exhaling, in 65% of patients. Dyspnoea is seen in 20% of patients, while tachycardia is seen in less than 45% of patients. (Marc Righini, 2017). Mr. X had chest pain, which was sharp and intense, mild shortness of breath, and tachycardia, when presented to ED.

Acute coronary syndrome was another possible diagnosis, which can be life-threatening. Patients with ACS can show either typical and atypical symptoms. Typical symptoms of ACS include chest pain, chest pressure or tightness, chest discomfort and pain radiating to neck, jaw, shoulder or arms. Some patients experience atypical symptoms such as dyspnoea, pain in abdomen, nausea, vomiting or syncope. (Cervellin.G & Rastelli.G, 2016.) A study was conducted on 736 patients who presented to four ED's between 2011 and 2013, to investigate sensitivity, specificity and gender differences in symptoms of ACS. Results revealed that chest pressure, chest discomfort, and chest pain had the highest sensitivity for ACS in both women (66%, 66%, and 67%) and men (63%, 69%, and 72%), respectively. Shortness of breath was found in 58% of female and 41% of male patients. Palpitations were found in 27% of female patients as opposed to 17% of male patients. (DeVon et al., 2014) (Holli. A. Devon, 2014). Mr. X experienced sharp and intense chest pain, radiating to other areas along with palpitation and mild shortness of breath.

Musculoskeletal chest pain was suspected on Mr X as he reported that he had been involved in lifting and shifting of heavy items in the morning. Activities like heavy lifting or shifting of heavy objects can result in trauma to the chest wall. This can cause sprain or strains to the muscles of the chest wall. (Richard N. Fogoros, 2019).

Diagnostic tests

The Three diagnostic tests done to identify the cause of chest pain and formulate diagnosis were Electrocardiogram (ECG)

ECG was introduced more than 100 years ago, and it still remains as an accessible, inexpensive yet a pivotal diagnostic tool in the field of cardiology. (Boyle & Vohra, 2017) (Noel G. Boyle, 2017). ECG is extensively used as a screening tool for STEMI in ED's, as it helps in timely diagnosis in 10 minutes of patient presentation to ED and timely intervention. A cohort study was conducted in seven different ED's in the USA in 2014, to evaluate the performance of using early ECG as a screening tool to detect STEMI. This screening criteria comparatively demonstrated superior performance, with the sensitivity and specificity ranging from 65% to 97% and from 81% to 97%, respectively. (Yiadom et al., 2017) (Maame Yaa A. B. Yiadom, 2017).

Another diagnostic test considered was Troponin blood test. Troponins, mainly troponin I, T, C are a group of contractile proteins present in cardiac and skeletal muscle. In the event of injury to the cardiac muscle, cardiac troponins are released from the cardiac muscle cells to the bloodstream. Within three hours of the onset of chest pain, there will be an elevation in the levels of troponin, and continue to rise until a peak is reached, usually between 12 and 48 hours. The measurements of the troponin, when checked between six to 12 hours, were found to have nearly 100 % sensitivity. (Stark & Sharma, 2020) (Matthew Stark, 2020). High sensitivity cardiac troponin I and T tests are the latest generation biomarker tests which help in the early diagnosis of myocardial damage. (Brush, et al., 2017). Because of the fact that high sensitivity cardiac troponin I and T allows detection of very low levels of these enzymes with precision, they are regarded as Gold standard biomarkers for diagnosing Acute Myocardial damage. (Aydin Suleyman, 2019).

When a blood clot begins to breakdown, it releases D-dimer. A normal D-dimer is less than 0.50. Any value more than 0.5 is regarded as positive D-dimer. (Emily J. Bounds, 2020). In the emergency department, measurements of D-dimer are considered as important and economical tool in differential diagnosis of acute chest pain which includes life threatening conditions such as PE, AMI and Aortic dissection. (Kathrin Hahne, 2014). A study was conducted to identify the ability of D-dimer to rule out the diagnosis of PE on 1585 patients, who presented with symptoms of PE in various outpatients and emergency departments. Results indicated that a negative D-dimer tests are excellent at ruling out PE and determining people without PE, whereas people with a raised D-dimer (false positive) people may not in fact have a PE. D-Dimer had a high sensitivity ranging between 80% to 100%, but the specificity only ranged between 23% to 63%, in diagnosing PE. (Crawford et al., 2016) (Fay Crawford, 2016).

Diagnostic Reasoning

Pulmonary embolism was suspected to be a potential diagnosis. Mr X had a history of a recent

trip to California, a week ago. Long-distance flights increase the risk of venous thromboembolism (VTE) (Almotairi, 2017). Flights of duration more than eight hours and presence of risk factors such as advanced age, obesity, limited mobility increases chances for a thromboembolic event (Naouri et al., 2016). Considering factors such as advanced age, obesity, limited mobility and maternal history of DVT, PE was included in the differential diagnosis.

VTE is a condition in which a blood clot develops in a vein. DVT and PE are subsets of venous thromboembolism. DVT occurs when a clot forms in deep veins of lower legs, thigh, hip and occasionally in arms. When a clot breaks off, it travels through the venous supply to reach the right chambers of the heart and goes into the lungs to form a life-threatening blockage in arteries of the lungs, which is known as Pulmonary embolism. (Centers for Disease Control and Prevention, 2020). Upon lodgement into the pulmonary arterial system, PE causes hypoxemia and gas exchange abnormalities. Physiological mechanisms involved in hypoxemia include ventilation-perfusion mismatch and shunt. Cardiac output and blood flow are redistributed from obstructed areas of pulmonary vascular bed to the uninvolved areas resulting in disparity in the ratio of ventilation to perfusion in lung compartments. In pulmonary shunt, alveoli are perfused but poorly ventilated. Blood flowing past this alveolus is deficient in oxygen and returns to the heart to mix with oxygenated blood. The total oxygen concentration in the arterial blood is greatly reduced as a result of this mixture producing hypoxemia (Turetz et al., 2018).

Patients with PE shows essential symptoms such as shortness of breath, blue lips and nails, syncope and haemoptysis. (Madsen & Hess, 2016). Mr X had mild shortness of breath, but his oxygen saturation was 95% on room air. Lips were pink and capillary refill was less than two seconds. No varicose veins detected. Hair was evenly distributed bilaterally in limbs. There was no haemoptysis. Mr X did not have a previous history of PE, DVT and recent surgeries. D-Dimer was tested for this patient and was negative. A negative D-dimer can be used to safely rule out PE, as it has a high level of sensitivity. (Harringa et al., 2017). It is highly recommended to avoid imaging studies like a CT scan or pulmonary angiography on patients with negative D-Dimer results, considering the radiation exposure and cost. (Francis et al., 2019). No imaging studies were done for this patient. Based on clinical presentation, physical examination and a negative D-Dimer result, PE was excluded.

Acute coronary syndrome was considered as another potential diagnosis. Factors like obesity, hyperlipidaemia and hypertension increase the incidence of ACS in elderly patients. (Ahmed A Reda, 2018). Mr X is in his sixties with a history of Hypertension, Hyperlipidaemia and Obesity. Chest pain accompanied along with symptoms like diaphoresis, vomiting, pain radiating to arms and increased pain on exertion are consistently seen in Acute coronary syndromes. (Dezman et al., 2017) (Zachary DW Dezman, 2017). Mr X had chest pain, radiating to neck, jaw, left arm and diaphoresis.

ACS includes a broad range of clinical conditions such as ST-segment elevation Myocardial infarction (STEMI), NSTEMI and Unstable Angina and is associated with sudden, reduced blood flow to the heart. When there is a prolonged loss or reduction in blood supply to the myocardium, it results in myocardial ischemia. This leads to the death of myocardium, which is known as Myocardial infarction. The reduction in blood supply is caused either, by a rupture or erosion of an atherosclerotic plaque. This disruption of the plaque triggers thrombosis with platelet activation and aggregation. Thrombosis consequently occludes the coronary artery and results in ischemia of the myocardium. (Kendall, 2018).

Myocardial ischemia releases biomarkers such as troponin into the blood, which can be measured in the laboratory and produces characteristic symptoms and ECG changes. In NSTEMI, cardiac biomarkers of necrosis elevate in the absence of persistent ST-Segment elevation (Pollack et al., 2020). ECG on Mr X showed no ST-Segment elevation but, ST depression in lead 2 and T wave inversions in lateral leads. An ECG showing ST-segment depression is suggestive of NSTEMI. (Basit et al., 2020). Initial Troponin studies showed a high sensitivity troponin level of 89 nanograms/litre(ng/L), while the normal range is between zero to thirteen ng/L (Wellington SCL, 2016). It was planned to repeat the test for troponin high sensitivity after two hours. A recent American Heart Association guideline suggest to test troponin at presentation to ED and three to four hours after the onset of symptoms in patients at risk for Myocardial Infarction. (Amsterdam et al., 2014). After two hours, troponin test was repeated and the level rose to 167 ng/L. Based on the clinical exam, ECG findings and elevated troponin levels, the diagnosis of NSTEMI was confirmed.

Conclusion

Chest pain is a multifarious symptom with numerous diverse causes with some being non-urgent and non-cardiac conditions such as Musculoskeletal disorders and others being life-threatening which includes entities such as ACS and PE. A patient suffering from myocardial ischemia may be presented with diverse symptoms such as chest pain, pressure on the chest, pain in arms, neck, jaw and shoulders, dizziness or palpitations. The care of Mr X in ED followed a systematic approach to Chest pain, which includes an assessment of risk factors, a detailed clinical examination considering the presenting signs and symptoms, a timely 12 lead ECG and interpretation and laboratory investigation of cardiac biomarkers. It is essential to treat patients with chest pain as time-critical until emergent causes of chest pain are ruled out. A fast and prompt diagnosis and treatment is paramount to protect the patient from life-threatening conditions.