
Human Anatomy: Cardiovascular System

Introduction

The purpose of this essay is to explain to the reader the cardiovascular system and to also widen the readers knowledge of this system. This will also include a case scenario which will look at a person that is suffering from active chest pains and other symptoms more commonly linked to a possible Myocardial Infarction.

Heart and circulatory diseases (Cardiovascular Disease) CVD is an umbrella term used to describe conditions such as coronary heart disease, heart failure and atrial fibrillation. These conditions can be inherited or develop later in life. There are about 7.4 million people within the UK suffering with heart and circulatory disease, with improved survival rates an ever increasing and ageing population this figure will most certainly rise. Heart and circulatory disease accounts for 27% of all deaths in the UK, approximately 170,000 deaths a year. (Heart Foundation July 2020).

Describe the location, structure and function of the heart.

The human heart lies within the protective thorax, posterior to the sternum and costal cartilages, and rests upon the superior surface of the diaphragm. The heart occupies an oblique position in the thorax, with two-thirds to the left of the midline. It occupies a space between the pleural cavities called the middle mediastinum.

The heart weighs between 200 to 425 grams and is a little larger than the size of your clenched fist, by the end of a long life, a person's heart may have beat more than 3.5 billion times. (Texas Heart Foundation)

The heart is a pump of muscular design that serves two functions, to collect blood from the tissues of the body and pump it to the lungs and to collect blood from the lungs and pump it to all the tissues of the body. (Weinhaus & Roberts)

The structure of heart is made up of three layers: the pericardium, the myocardium, and the endocardium. The inner wall of the heart is lined by the endocardium. The myocardium consists of the heart muscle cells that make up the middle layer and the bulk of the heart wall. The outer layer of cells is called the epicardium, the second layer of which is a membranous layered structure (the pericardium) that surrounds and protects the heart; it allows enough room for vigorous pumping, but also keeps the heart in place, reducing friction between the heart and other structures. (bio.libretexts.org)

The inside of the heart is made up of four chambers, two to the left and two to the right. The two upper chambers are called Atria and are the smallest of the chambers, the two below are called Ventricles, the left and right sides of the heart are divided by thin muscular wall called the septum. (bhf.org)

Describe the flow of blood through the heart to include deoxygenated and oxygenated routes.

The left and right sides of your heart work in conjunction with each other and continuously pump blood to the heart, lungs and body. Deoxygenated Blood enters into the right atria through two large veins on the right side of the heart, these are the inferior and superior Vena Cava. As the right atrium contract's it flows deoxygenated blood through the Tricuspid valve into the right ventricle, once the ventricle is full the tricuspid valve closes to prevent blood from flowing backwards when the ventricle contract's. As the right ventricle contract's the blood then flows through the pulmonic valve and then travels via the pulmonary artery to the lungs where the exchange of gases will take place (diffusion) where carbon dioxide is removed as waste and fresh oxygen is supplied to the deoxygenated blood.

The freshly oxygenated blood will then travel via the pulmonary vein from the lungs to the left atria of the heart, as the atrium contract's the blood flows into the left ventricle through the mitral valve which will also close to prevent blood flowing backwards when the ventricle contract's. On contraction of the left ventricle blood flows through the aortic valve and then into the ascending aorta and then the oxygenated blood is pumped around the body supplying it with freshly oxygenated blood. This pattern is then repeated continuously to maintain a constant supply of freshly oxygenated blood to the body.

As with all organs within the body, the heart requires a supply of oxygenated blood to main its correct operation, even though the heart chambers are full of blood the heart does not receive any nutrients from this blood, the heart receives its own supply of blood from a network of arteries called the left and the right coronary arteries. These arteries provide blood to the left and right atriums and also the left and right ventricles while providing oxygenated blood to the whole myocardium, the coronary arteries originate at the ascending aorta and branch off from where the aorta and the left ventricle meet. (webmd)

Provide a definition of a myocardial infarction.

The definition of a myocardial infarction (MI) according to the World Health Organisation (WHO 2008-09 Revision) is when there is a demonstration of myocardial cell necrosis due to significant or sustained ischemia, this is usually, but not always caused by acute atherosclerosis-related coronary heart disease. An MI normally occurs due to coronary heart disease, which is caused by an obstruction to the coronary arteries due to plaques (WHO) The presentation of myocardial infarction can vary from a minor coronary event to life threatening conditions or sudden death.

The WHO definition and diagnostic criteria for myocardial infarction are met when there is evidence of myocardial ischemia in a clinical setting and also when any one of the following criteria are met, the rise or fall of cardiac biomarkers (troponin), symptoms of ischemia including combinations of chest, upper extremities, jaw or epigastric discomfort. ECG changes showing evidence of new ischemia including new ST-T changes or a new left bundle branch block (LBBB) finally imaging evidence of new loss of myocardium. (WHO Santhi Mendis)

Identify modifiable risk factors associated with this patient and

explain how these could be contributing to the presenting complaint.

In reference to the person in Appendix A. According to Heart Foundation cardiovascular disease (CVD) which can also be known as heart and circulatory disease includes conditions that can lead to the narrowing or blocking of blood vessels. This can then lead to heart attacks, angina and some strokes. Heart disease can also be responsible for causing changes to the heart muscles and valves. (bhf.org) With the patient's history of illness and his ongoing lifestyle, there is a high chance that this has contributed to the presenting condition of a myocardial infarction. Coupled with his previous job history of working within a smoke filled atmosphere and passive smoking and the large intake of alcohol for many years. Statistics for England show that during the 2017-2018 period 489,300 people were admitted to hospital that could be attributed to smoking and a further 77,800 deaths attributable to smoking (nhs.uk statistics on smoking, England 2019). The patient also has a history of Type 2 Diabetes Mellitus which according to Diabetes.co.uk can contribute towards cardiovascular disease (CVD) with a Diabetes report from 2007 stating that the risk of CVD in people with Diabetes is 5 times higher in middle aged men and 8 times higher in women with Diabetes. (Diabetes.co.uk)

Modifiable risks in this patient would include his lifestyle choices over the years, including his obesity, alcoholism and smoking coupled with his gender and age. The correct management of his Diabetes to minimise the further risk of CVD and further changes including the stopping of smoking and a healthier lifestyle towards his eating habits and weight control would help in the further risk of a secondary myocardial infarction. The heart foundation state that the risk of CVD can be reduced by firstly lifestyle changes but also medication, a pacemaker, stents and heart surgery. (bhf.org)

Within your scope of practice as an Emergency Medical Technician describe your ongoing assessment and management of this patient.

The following part of this essay is in Reference to the information provided in Appendix A.

While working as an emergency medical technician (EMT) and on arriving at the patient my initial assessment will include the risk of any further dangers to the emergency ambulance crew and the patient, at the same time when seeing the patient for the first time I would be looking for any presence or evidence of a catastrophic haemorrhage, I would also be talking to the patient to assess his level of consciousness, in this case he is conscious and complaining of feeling anxious and also sweating profusely and complaining of feeling cold, these being clinical signs of a possible cardiac issue. Good communication with the patient at this point will indicate to me his airways are clear of obstruction. I would then check his breathing, including his respiratory rate (SaO₂: 97% on ambient air) and a good respiratory rate of 20 BPM with clear lung fields. No oxygen therapy would be needed at this point unless his oxygen saturations dropped below the recommended levels (JRCALC 2019 Guidelines) A regular pulse of 80 BPM would indicate that the patient's circulation is working adequately and is well perfused but is hypertensive with a blood pressure of 160/100 mmHg. I would then proceed to carry out a 12 Lead Electrocardiogram (ECG) showing 3mm of elevation in leads ii, iii & aVF indicating an inferior myocardial infarction. As an EMT my scope of practice allows me to assess the ECG findings as Abnormal and not as being a myocardial infarction, even if the ECG is showing 3mm of elevation in three leads. During my assessment I would also take the patients temperature and

his blood sugar levels (BM) At this point with the patients presenting complaints and his history, also with an abnormal ECG. I would inform control and request back up in the form of a Paramedic who would be able to provide a higher level of pain relief (Pain score of 8/10) via intravenous access and the use of Morphine Sulphate and any further advanced treatment required if the patients condition worsened. I would assess the patient's condition as being of a critical nature. If not already taken with telephone advice from the 999 call taker, I would give the patient 300 mg of Aspirin to chew and swallow, (JRCALC 2019) this would also depend on any allergies the patient has to medications. I would at this point advice the patient to take his own Glyceryl trinitrate (GTN) if he has this, this would provide some pain relief, (the patient's blood pressure being 160/100 mmHg) I would also monitor this for any reduction in the pain score. As per my scope of practice and under JRCALC 2019 guidelines I could also give the patient one Gram of oral Paracetamol in the form of tablets to aid with the pain relief as it would appear that not Paramedic back up is available, at the same time acting in a calm and reassuring manner to the patient. I could also offer the patient pain relief in the form of Entonox (Nitrous Oxide) but only if the patient is capable of administering this himself and there is no contra indications as per JRCALC 2019 Guidelines. At all times I would document the patient's symptoms, history and any medications administered along with any further relevant information. I would also closely continue to monitor the patient's condition and observations.

Under my scope of practice I would then prepare an ASHICE with all the patient's relevant details and the latest set of observations, then pre-alert this person to the nearest receiving emergency department including an estimated time of travel. At present and due to the risk of infection from Covid-19 before arriving at scene I would don the relevant personal protective equipment as laid down by the Welsh Ambulance Service Trust (WAST) these precautions would remain in place until the patient has been off loaded at hospital. During my history taking of the patient I would also include any relevant information to do with recent temperatures or persistent coughs and any family members possibly suffering Covid symptoms. The receiving emergency department would be made aware of any relevant information concerning the patients symptoms or contact with Covid-19.

Appendix A

Case Scenario.

John Jones is a 66 year old retired landlord. He is complaining of central chest pain that is radiating to his Left arm. This began 30 minutes ago with a dull ache but now the pain is sharp and constant.

You are presented with an obese male who has the following observations:

Pulse: 80 regular

B.P: 160/100 mmHg

Respiratory rate: 20 breathes per/min. Clear lung fields.

SaO2: 97% on ambient air

NPS: 8/10

He is anxious, sweating profusely and complaining of feeling cold.

ECG shows 3mm of elevation in leads ii, iii & aVF indicating an inferior myocardial infarction.

The patient's past medical history includes type ii diabetes mellitus, ischaemic heart disease and asthma. He has been a smoker for 50+ years smoking on average a pack each day and a heavy drinker all his adult life consuming 10 units p/day.

Reference List.

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