Current clinical management of NSTEMI and STEMI

Goals: The goal of this article is to address current clinical management of NSTEMI and STEMI patients by Registered Nurses in a hospital setting.

Objectives: After reading and working through the questions, the reader should be able to

1. Differentiate between an NSTEMI and STEMI

2. Identify best clinical best practices for each patient population

3.Discuss benefits and risks associated with current revascularization and antiplatelet therapies.

Introduction: STEMI (ST elevation myocardial infarction) and NSTEMI (non-ST elevation myocardial infarction) are emergencies that require immediate medical attention. It is important to address this problem in a timely manner to prevent as much permanent damage as possible to the heart muscle. Interventions may include revascularization by the use of thrombolytics which are medications that can break apart a clot or PCI (percutaneous coronary intervention) which opens the blocked vessel with the use of a catheter. Dye is injected into the vessel to visualize the occlusion. The vessel is then opened and a stent is possibly left in place. Both STEMIs and NSTEMIs are a growing concern in our aging population.

Background of the problem- Myocardial Infarction is a major contributor to the number one cause of death in the United States which is heart disease. NSTEMI and STEMI are types of myocardial infarctions that are differentiated based on changes seen on an EKG. Unstable angina is also a common cause of chest pain that is typically relieved with rest and is not caused by an infarction. All three should be evaluated and taken seriously as both an NSTEMI and Unstable Angina can progress to a STEMI. Once patients are admitted with one of these diagnoses

complications can occur. It is important that the Registered Nurse is able to recognize important changes in patient's conditions and anticipate appropriate interventions for the patient.

Pathophysiology- During both a STEMI and an NSTEMI, oxygen supply to cardiac muscle is reduced. In an NSTEMI the reduction in blood flow is assumed to be from a complete occlusion of the coronary artery. The most likely cause of this occlusion to the coronary artery is due to a plaque that has dislodged from a vessel. When a plaque begins to dislodge from a vessel, a thrombus forms at the site which causes the occlusion of blood flow. This obstruction of blood flow causes the classic chest pain symptoms associated with heart attacks. It is possible that this pain is experienced as referred pain or stomach upset.

Risk factors- Risk factors for the development of Myocardial Infarctions include both lifestyle as well as genetic factors. Diet, exercise, and smoking are high contributors to the formation of plaques and eventual development of a myocardial infarction. (Basu, J, Sharma, S,2016). Foods high in cholesterol contribute to the formation of plaques in the arteries. Some patients have a strong family history of elevated cholesterol and hypertension which can contribute.

Clinical symptoms- The textbook clinical symptoms that patients typically experience include a crushing chest pain. The chest pain is often described as a heavy pressure and can cause shortness of breath. The pain may increase with movement and may radiate to other locations such as down one arm, across the back, as well as up the jaw. Other symptoms may include sweating and nausea as well as symptoms that may be confused with heartburn. In patients with unstable angina, they will no longer find relief from chest pain with rest.

Diagnostic evaluation- An initial evaluation of the pain the patient is

experiencing can be helpful in ruling out potential non-cardiac differentials. A sharp pain particularly when breathing in could be associated with pleuritic pain caused by inflammation of the pleural cavity. Pain that increases when the nurse palpates the area could be musculoskeletal.

Upon arrival to the hospital, the current recommendation is to complete an EKG within 10 minutes of arrival. Frequently an EKG has already been completed in the field. It is important to compare the new EKG to any old ones available to look for changes. An EKG may show changes that could indicate a STEMI which could include elevation of the ST segment by at least 1mm in two or more continuous limb leads or greater than 2mm elevation in two or more precordial leads (Basu, J, Sharma, S,2016). A new left bundle branch block is also concerning for the presence of a STEMI. An NSTEMI will not show ST elevation but may show ST depression of at least 1mm as well as T wave inversions. It is important to try to take the EKG prior to the administration of any medications for the relief of chest pain as these can resolve any EKG changes that have appeared as a result of an infarction.

Various imaging studies can assist in ruling out non-cardiac differentials. A chest x-ray obtained upon arrival can show possible pneumonia as seen by a pleural effusion that could be a cause of chest pain. An echo can reveal areas of the heart that have been damaged as well as how effectively the blood is pumped out (ejection fraction). Damaged areas may appear as sites with hypokinesis. An abdominal ultrasound can reveal additional serious causes of sudden pain such as an Aortic Abdominal Aneurysm (AAA). A AAA is also a medical emergency that would follow a different course of treatment.

Lab work can reveal possible comorbidities and is also used to confirm a STEMI or NSTEMI. Comorbidities may affect the course of treatment and can point to additional issues that need to be addressed. A positive troponin in the presence of t wave inversions or ST

depression would indicate an NSTEMI. Increased BNP levels could indicate a history of CHF. Imbalances in Mg, K, and Na could further irritate the heart muscle and cause dysthymias. Replacement of these levels can prevent development of dysthymias. PTT and INR can indicate whether or not the patient has been taking any prescribed anticoagulants correctly and if they are at a therapeutic level.

Clinical management- Initial intervention by the nurse is to provide relief of pain and stabilize vital signs. Oxygen is applied when oxygen saturation is less than 90%. Administration of 325mg of aspirin with a PY12 receptor inhibitor such as Clopidogrel, Prasugrel, or Ticagrelor are commonly given as antiplatelets initially. The most recent recommendations are that patients remain on this dual antiplatelet therapy for 6 months after the event (O'Gara, P, 2013). For pain relief, patients are given sublingual Nitro or Nitro paste. It is important to check the patient's blood pressure and whether or not they have taken phosphodiesterase inhibitors within the past 48 hours. Taking nitro with the recent administration of phosphodiesterase inhibitors can cause severe hypotension and death. IV morphine is also administered for pain relief and will aid the patient in feeling less short of breath due to its vasodilatory effects. Care should also be taken by the nurse to ensure that the patient is not hypotensive prior to administration.

For patients who are experiencing a STEMI, the goal door to balloon time is 90 minutes in order to perform a primary PCI procedure or a transfer to a PCI center within 90 minutes (Menees, Peterson, Wang, Curtis, Messenger, Rumsfeld, & Gurm, 2013). In the event that the patient cannot receive primary PCI within 90 minutes, the patient should receive finbrinolysis to open the occlusion. For patients that present with an NSTEMI (positive troponins with ST depression), early intervention is associated with lower mortality in studies. In some cases,

patients experiencing a STEMI may receive a thrombectomy with the PCI procedure. During this procedure, the thrombus that occluded the vessel is aspirated (Briasoulis, Palla, & Afonso, 2015). In a recent meta-analysis of studies utilizing thrombectomy in STEMI patients, no difference in patient mortality or reinfarction was found (Briasoulis, Palla, & Afonso, 2015).

Cardiogenic shock is also a possible and common complication of MI that can increase patient mortality in both STEMI and NSTEMI cases (Shah, Lemos, Wang, Chen, Thomas, Sutton, & Granger, 2016). During cardiogenic shock, the heart cannot pump enough blood to meet the oxygen demands of the body. The damage to the heart is usually in the area of the left ventricle which is responsible for pumping blood out to the body. Symptoms of Cardiogenic shock include hypotension without hypovolemia, poor pulses and cool extremities.

Early revascularization is recommended in patients who arrive in cardiogenic shock (Kastrati, Colleran, & Ndrepepa, 2016). Revascularization in this patient population is performed by PCI or possibly Coronary Artery Bypass Graft (CABG) when multivessel. Intra-aortic balloon counterpulsation (IABP) is recommended in the latest American Heart Association Guidelines in patients who have a STEMI with cardiogenic shock that cannot be quickly reversed (Antman, 2004).

Clinical considerations: After admission with an MI, the Registered Nurse should be aware of several clinical complications that are commonly found in this population. The registered nurse should be aware that the dye used in the PCI/angiogram procedure can be damaging to the kidneys. Close monitoring of kidney function should take place in patients with known kidney disease. Patients should be encouraged to drink water after the procedure. Physicians may order fluids to protect the kidneys prior to and after the heart cath procedure. and hypothermia in STEMI patients.

After the PCI procedure, patients are frequently brought back to the floor with a TR band or gauze bandage in place where the cath procedure has been completed. Slow withdrawal of air from the band and bedrest for patients who received femoral cath access is important. In the event of bleeding at the radial site, air should quickly be replaced and observed for further bleeding.

There is great interest in the possible benefits of therapeutic hypothermia in patients who experience a Myocardial Infarction. Most studies have taken place in animals and show a possible cardioprotective effect (Chavez, Leon, Einav, & Varon, 2016). Hypothermia protocols are currently used in patients who have experienced a cardiac arrest and have shown increased neurological improvement as well as increased survival (Chavez, Leon, Einav, & Varon, 2016). Much of the research surrounding cardioprotective effects has been performed in animals. There is inconsistent evidence that hypothermia may decrease the size of the infarct in humans (Chavez, Leon, Einav, & Varon, 2016). Research in this area continues.

Nursing management considerations - Appropriate administration of antiplatelets and anticoagulants by Registered Nurses is crucial in patients who have experienced a Myocardial Infarction. IV Heparin is commonly administered in the hospital setting as an anticoagulant in this patient population. It's short half- life allows for the drip to be stopped and interventional procedures to be performed as necessary. Careful titration using PTT or AntiXa values is important.

IV antiplatelets that are increasingly used in this patient population include abciximab, eptifibatide, and tirofiban hydrochloride. These antiplatelet medications inhibit the Glycoprotein IIb/IIIa receptor and are frequently used in patients undergoing PCI procedures. This receptor participates in platelet aggregation by fibrinogen (Thachil, 2016). They are used to reduce

platelet aggregation in patients with Acute Coronary Syndrome. As these medications are given by IV and they have a rapid onset. Eptifibatide in particular has an immediate onset with a half-life of 2.5 hours, and duration of 4-6 hrs (Rader & Terry, 2017). Adverse effects include thrombocytopenia, bleeding, and anaphylaxis. The drug dosage should be adjusted for eptifibatide and tirofiban hydrochloride in patients with a low creatinine clearance. These drugs can be used in pregnant women if needed. Eptifibatide is incompatible with furosemide and tirofiban hydrochloride is incompatible with Diazepam. All three glycoprotein IIb/IIIa inhibitors can be used with heparin and aspirin (Rader & Terry, 2017).

GI bleeds are a common side effect of antiplatelet and anticoagulant medications. The Registered Nurse should monitor for this side effect by testing the patient's stool for occult blood. Patients in this population are also frequently prescribed PPIs in order to prevent GI bleeds.

Clinical Case Study:

Consider two patients who both arrive to the same hospital which has Percutaneous Coronary Intervention (PCI) available on-site and are exhibiting symptoms consistent with a possible infarct. These case studies are to enhance your understanding of the topics covered above.

Patient A is a white male in his early sixties who has had episodes of chest pain in the past. His history includes hypertension, hypercholesterolemia, and an MI 10 years prior. He arrives to the hospital after experiencing chest pain that is unrelieved with rest at home. The pain has been increasing and is causing him to sweat profusely as well as feel short of breath. Upon admission, his vital signs are 98.8 degrees Fahrenheit temperature, blood pressure of 175/88, heart rate of 75, respiratory rate of 24, and Oxygen saturation of 87%. 2L of Oxygen by nasal

cannula is placed on him as his O2 saturation is at 87%. An EKG is completed and ST elevation is seen on the lateral leads. He is given aspirin as well as sublingual nitro with some relief of his chest pain. He is then given IV morphine which temporarily relieves his chest pain. A series of lab work is completed and his initial troponin test is positive. Patient A is immediately taken to the cath lab for PCI. He has a stent placed to his Left Anterior Descending Artery. Patient A arrives back on a telemetry floor to recover. He is monitored for bleeding from an attempted radial site as well as a femoral site where the cath was performed. The nurses also monitor for any additional episodes of chest pain and EKG changes. He is started on Plavix and aspirin to prevent reocclusion of the stent. Prior to discharge, the nurses emphasize the importance of continuing to take Plavix exactly as prescribed. Missing even one dose could cause reocclusion.

Patient B is also a white male in his early sixties. He has never had an episode of chest pain in the past. He considers himself to be in good shape and eats a pretty well balanced diet. He is mindful of his salt intake since he has hypertension which he also manages with oral medication. He also watches his potassium intake as he has been diagnosed with chronic kidney disease. One day while cleaning out his garage he begins to feel some stomach discomfort. His stomach discomfort is unrelieved by his usual GERD medication. The discomfort also seems to be spreading. He has a friend take him in to the hospital where his vital signs are taken. His temperature is 98.2 degrees Fahrenheit, blood pressure 165/85, heart rate 85, respiratory rate 18, and oxygen saturation 94%. An EKG is completed and no changes are seen. A series of lab work is completed and his initial Troponin test is positive but low. It is unclear if this is elevated above normal due to his kidney disease or due to myocardial damage. The physician has the patient admitted to a telemetry unit for further observation and evaluation in the morning. Additional Troponin levels are ordered for every 6 hours.

After arrival to the unit, Patient B has two additional positive Troponin tests that continue to increase until they reach a critical value. He also experiences an additional episode of what he describes as gastric pain/discomfort. This is relieved with IV morphine. An additional EKG was also done with no changes seen. The on call physician is called and requests that the patient is started on IV heparin for ACS indications. The nurse gets a STAT PTT on the patient and once the value is obtained, initiates the drip. The physician also requests that the patient is prepped for a cath in the morning.

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