Honors Thesis
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PASS WITH DISTINCTION
Therapeutic Interventions for Patients with Congestive Heart Failure

Rita Arnold
Washington State University
Intercollegiate College of Nursing
Honors College
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Abstract

Cardiac disease is the number one cause of death among adult Americans. In 1998, 459,841 individuals died of coronary heart disease and 7,300,000 suffered a heart attack. Every 29 seconds an American will suffer a coronary event, and about every minute someone will die from one (American Heart Association, 2001). Many of the risk factors are as simple as being a man over the age of 45 or a woman who has gone through menopause. A family with a history of cardiac disease, diabetes, cigarette smoking, high blood pressure, obesity, a sedentary lifestyle, elevated levels of cholesterol and stress are more likely to suffer from coronary artery disease (CAD) (McGowan & Chopra, 1997). In 1997, the economic cost of coronary artery disease was estimated at almost $10.8 billion (American Heart Association).
Coronary Artery Disease vs. Congestive Heart Failure

CAD is the narrowing of one or more coronary arteries by a blockage called atherosclerosis. This is the build up plaque, made by the composition of fats deposited in the artery wall. Why plaque starts to build in the artery is not exactly known. It is believed that the inside of the wall of the coronary artery is damaged by substances inside the body such as carbon monoxide from cigarettes, high blood sugar from diabetes, high cholesterol, high blood pressure, or high adrenaline levels from stress. The body then reacts to the damaged areas by laying down a layer of plaque.

Heart failure is when another condition weakens the heart, resulting in congestive heart failure (CHF). “Heart failure is defined as insufficient cardiac output due to cardiac dysfunction” (Banasik & Copstead, 2000). A few conditions that weaken the heart and cause CHF are: CAD, heart attack or myocardial infarction (MI), high blood pressure, heart valve disease, and cardiomyopathy.

HOW THE HEART WORKS

The heart is a relatively small organ that weighs 300 g and is approximately the size of a fist. It is located in the middle of the mediastinum, where the lungs partially overlap it (Marek, Phipps, & Sands, 1999). The heart is divided into two
halves by a muscular wall (septum). Each half has an upper collecting chamber (atrium) and a lower pumping chamber (ventricle). Blood that is depleted of oxygen enters the right atrium and flows from the right atrium to the right ventricle. The right ventricle pumps the blood into the pulmonary artery and is taken to the lungs (Marek et al.).

Blood reaches the tiny capillary network that rests against the alveoli of the lungs. Oxygen equilibrates across the alveolar-capillary membranes by simple passive diffusion, moving from an area of greater partial pressure to a region of lesser partial pressure (Woods, Sivarajan-Froelicher, & Underhill-Motzer, 2000). Carbon dioxide (a bi-product of cell metabolism) also flows from the blood into the lungs and is expired from the body upon expiration.

This oxygen rich blood is returned to the heart via the pulmonary vein and deposited into the left atrium. The blood flows to the left ventricle and then is ejected into the aorta and distributed to the organs and tissues of the body. This sequence of events happens approximately 72 times per minute, with more than 5 Liters of blood pumped each minute, or about 2000 gallons per day (Marek et al., 1999).

There are three main coronary arteries surrounding the heart, the right coronary artery (RCA), the left coronary artery (LCA), and the circumflex artery (Cx) (Marieb, 1995). They
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carry blood with oxygen deep into the heart muscle. When a coronary artery becomes narrowed, the blood flow to the heart muscle is significantly reduced, causing angina pectoris, or chest pain. Angina pectoris is a term that describes the way a person feels when their heart does not get enough blood and oxygen. There may be discomfort (a feeling of tightness, squeezing, aching, or indigestion), discomfort in the jaw, throat, arm, neck, or upper back, called referred pain (Banasik & Copstead, 2000). Shortness of breath, weakness, sweating or dizziness are also signs of angina. Angina often occurs with exertion, stress or after a heavy meal (stable angina). At these times the heart is working harder and is not getting enough oxygen.

A myocardial infarction (MI) occurs when there is a complete occlusion in one of the coronary arteries. The occlusion persists long enough for the development of irreversible damage to myocardial cells. A complete blockage of a coronary artery is usually caused by a thrombus that has formed at the site of the already partially blocked or damaged area in the coronary artery. Blockage may also be caused by a spasm in the artery and is called Prinzmetal variant angina. In Prinzmetal angina, the onset of ischemic symptoms is unrelated to physical or emotional exertion, heart rate, or other obvious increases of myocardial oxygen demand (Banasik & Copstead,
RISK FACTORS

Coronary risk factors are conditions or behaviors which increase a person’s chance of having CAD. By modifying the following major risk factors, the progression of the disease may be altered. Smoking tops the list. Heavy smokers are two to four times more likely to have a heart attack than nonsmokers. The heart attack death rate among all smokers is 70 percent greater than among nonsmokers (American Heart Association, 2000).

Smoking contributes to heart disease in many ways. By smoking, carbon monoxide and nicotine are inhaled causing blood vessels to narrow, the heart to beat faster, and blood pressure to go up. All of these factors cause the heart to work harder, increasing the demands for oxygen. Carbon monoxide and nicotine also cause damage to the artery wall, which may lead to atherosclerosis. The risk of smoking has been shown to be related to the number of cigarettes smoked daily. In addition, red blood cells are also produced in excess with the inhalation of carbon monoxide, causing the blood to clot easier. This increases the chance of a blood clot forming in a coronary artery (Futterman & Lemberg, 2000).

High blood pressure is also a major risk factor for CAD. The higher a person’s blood pressure, there is a greater risk
Interventions that the person will develop heart disease or have a stroke.

Arterial blood pressure is the driving force that propels blood throughout the body. Blood pressure is closely regulated to maintain adequate perfusion pressure to vital organs. High blood pressure is classified as a pressure of 140/90 mmHg (millimeters of mercury) over three separate readings (American Heart Association, 2001).

High blood pressure is the increase in the force against arteries as the blood is circulating. Hypertension (high blood pressure) often has no symptoms until the late stages. Some patients do feel their "high blood pressure" and can be manifested by a headache or nosebleed. "Low blood pressure" is sometimes felt as dizziness. Blood pressure normally goes up as a result of stress or physical activity, but a person with hypertension has high blood pressure at rest.

Arterial blood pressure is recorded as a systolic and a diastolic value. For example, a blood pressure of 120/80, 120 represents the systolic value and 80 represents the diastolic value. Systolic blood pressure reflects the maximum pressure in the aorta and major arteries during ventricular ejection of the blood. The diastolic pressure reflects the minimum pressure in these vessels during the pre-ejection rest period (filling of the atrium and ventricles), just before the subsequent ventricular contraction (Banasik & Copstead, 2000).
There are risk factors that contribute to hypertension such as: age, race, obesity, and excessive sodium intake. Blood pressure rises consistently with age. Many vascular changes occur with the aging process. Vessel lumen narrow, and vessel walls become stiff and less compliant. This results in an increase in pressure in the vessels, called systemic vascular resistance (SVR). This contributes to increased blood pressure, primarily systolic blood pressure (Banasik & Copstead, 2000). High blood pressure also occurs two to three times more frequently in African-Americans than in Caucasians. Elevated blood pressure appears earlier in African-Americans and target organ damage is more severe than in Americans of European, Hispanic, or Native American descent. The reason for this difference is not known (Banasik & Copstead).

Excess weight is also associated with elevated levels of blood pressure. Obesity in childhood is a predictor of high blood pressure in adulthood. Body mass index (BMI, kilograms per meters squared) has been found to be closely correlated with diastolic blood pressure. As BMI increases, so does diastolic blood pressure. The mechanism by which excess weight contributes to high blood pressure is not known; however, a relationship between hyperinsulinemia (high levels of insulin), obesity, and hypertension has been noted. Weight reduction in overweight individuals is known to reduce blood pressure.
Also associated with high blood pressure is the intake of sodium. Studies indicate that in members of cultures with high sodium intake, arterial blood pressure is higher than in individuals from cultures with low sodium intake (Banasik & Copstead, 2000). Water follows sodium, which would therefore increase the amount of fluid running through the vessels, increasing the blood pressure.

Another factor affecting CAD is high cholesterol. Cholesterol and triglycerides are the two main blood fats (lipids). They are contained in food and produced by the liver, where they are also metabolized for excretion. Lipoproteins, which are produced by the body, carry lipids to and from body cells. The three main lipoproteins are: Low density lipoproteins (LDL), very low-density lipoproteins (VLDL), and high-density lipoproteins (HDL). LDLs carry cholesterol into the cells and therefore are considered bad. VLDLs carry triglycerides and HDLs carry cholesterol away from the cells and back to the liver for removal. These are considered good cholesterol and people with low HDL levels have more coronary artery disease (American Heart Association, 2000).

Total cholesterol levels below 200 mg/dl are desirable if the HDL is also 40 mg/dl or higher. High levels of total cholesterol are considered to be over 240 mg/dl. A HDL of 60
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mg/dl is considered protective against heart disease, actually reducing the risk. A person with a LDL of 160 mg/dl is considered healthy, whereas a person with a LDL greater than 190 mg/dl would be a candidate for drug therapy. People with a LDL in the range of 160-189 mg/dl are recommended to make a lifestyle change (Dai & Koffman, 2001).

Diabetes is a major disease that affects the heart along with many other organs in the body. Food is broken down into glucose (sugar), which is the body’s main source of energy. If a person has diabetes, they cannot properly use the energy from the food they eat. Insulin is a hormone that helps facilitate the movement of glucose into the body’s cells to be utilized (Banasik & Copstead, 2000). When a person has diabetes, they are lacking in insulin, which causes a buildup of sugar in the blood stream, causing vascular problems. People with diabetes also tend to have a higher level of fats in the bloodstream. For these reasons, people with diabetes have a higher risk for CAD (Banasik & Copstead).

The lack of physical inactivity also increases a person’s risk for developing heart disease. Even a person who has had a heart attack can increase their chances of survival if they change their habits to include regular physical activity. It can help control blood lipids (it increases HDLs and decreases LDLs), diabetes and obesity as well as help to lower blood
DIAGNOSTIC TESTS

A patient may present with the following symptoms, which would make them a candidate for any one of the diagnostic tests used to diagnose CAD. Severe discomfort in the chest, back, jaw, and shoulders or arms is a cardinal sign of angina or a MI. Feelings of indigestion or heaviness, nausea or vomiting, dizziness and shortness of breath, combined with one or more of the above risk factors is also a good indication that further evaluation of the patient needs to take place.

There are a number of non-invasive tests that can be done to determine how well the heart is working. These tests are much safer than invasive tests, and therefore are done first. An electrocardiogram (ECG) is one of the first tests chosen. This test is most useful when the patient is symptomatic. The 12-lead ECG represents 12 different anatomical views of the heart and is one of the most important diagnostic tools in the assessment of chest pain. The ECG interpretation for ischemia (lack of oxygen to the heart) focuses on the ST segment (the early part of right and left ventricular repolarization - diastole) of the ECG (Marek et al ., 1999).

Echocardiography is another non-invasive test, which uses ultrasound to assess cardiac structure and flow of blood through the heart. It can be used to diagnose several conditions
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including cardiac chamber size, stroke volume, and cardiac output. These three things are very important in the diagnosis of CAD and CHF. A transducer is placed on the patient’s chest, which transmits high-frequency sound waves and then receives these waves back from the patient as they are reflected from the various structures. These “echoes” are viewed on lines and spaces on an oscilloscope. These lines and spaces represent bone, cardiac chambers and valves, the septum, and muscle (Marek et al., 1999).

Another commonly used technique to evaluate myocardial perfusion is the application of the radionuclide thallium-201. Thallium-201 is injected intravenously at maximal exercise and is rapidly extracted from the blood by living cells in the myocardium (heart muscle). Radiological images are then taken, which reveal areas of absent, poor, or moderately poor uptake of thallium-201. When exercise images are compared with rest images, the differences in uptake of thallium-201 indicate areas of decreased blood flow. This information, along with the exercise tolerance test, can be more definitive in the evaluation of the extent and localization of ischemia (Woods et al., 2000).

Nuclear perfusion studies such as the thallium scan, may be preferred over echocardiography with patients who have conditions that make establishing an echocardiographic window
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more technically difficult. Examples of these types of patients include patients who are very obese, those with chest wall deformities (i.e. breast surgery), or those with significant lung disease (Lavie, Milani, & Mehra, 2000).

The exercise tolerance test (ETT) or the stress test, shows how the heart performs when the patients are exerting themselves. An ETT demonstrates the significance of coronary artery blockages relative to the patient’s functional status (Marek et al., 1999). The test includes having the patient walk on a treadmill with ECG monitoring. By observing an ECG during exercise, the doctor can tell if the heart muscle is getting enough blood.

The last of the non-invasive tests is the transesophageal echocardiography (TEE). It is a new approach using high-resolution ultrasound. The patient is sedated and the oropharynx (the throat) is anesthetized so the patient can swallow an endoscope (a camera at the end of a tube that allows visualization of hollow organs or cavities). The scope is advanced to the stomach, where flexion of the tip allows imaging of the heart through the stomach wall and the diaphragm. The endoscope is then slowly withdrawn and views of cardiac structures are obtained at several levels in the esophagus. Images obtained from within the esophagus or stomach are usually of much higher quality than other images due to the elimination
of acoustic impedance from the ribs, sternum, and air filled lungs. (Woods et al., 2000).

Patients, who have significant findings with the non-invasive tests and are in the high-risk category, should be considered for a right or left cardiac catheterization. This is a special x-ray study of the heart. A catheter is inserted into a vein or artery (usually an artery for a left-sided catheterization) in the arm or upper leg. The catheter is then guided through the larger blood vessels towards the heart. Once the catheter is in place, x-ray dye is then passed through the catheter which allows the doctor to see the arteries, chambers, valves, and pumping function of the heart. This is all visualized on a screen in the room during the time of the procedure. It is then saved to film for further, more in-depth evaluation by the cardiologist (Marek et al., 1999).

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Once all the treatable causes of the heart failure have been identified, treatment should be aimed at disrupting the cycle of failure (Macklin, 2001). For all cases, lifestyle changes are a must. Initiation of a medication regime is also a well-defined approach. And for patients whose disease has progressed beyond the realm of diet, exercise, and drug therapy, surgical interventions are needed.

Developing healthy eating habits and an exercise regime
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will not only help prevent CHF, but it will help the reoccurrence of symptoms after an intervention has been implemented. According to a review of 27 studies involving more than 30,000 healthy adults, a diet low in fat reduced deaths caused by heart disease by 9% and cut heart attacks and strokes by 16% (Rostler, 1999).

A healthy diet can reduce the risk factors of high cholesterol, hypertension, obesity and diabetes. A diet high in saturated fats (bad fat) contributes to high cholesterol. Conversely, wherever dietary fat consists mostly of monounsaturated fats and polyunsaturated fats (good fat) along with an abundance in fish, fruits, and vegetables, blood cholesterol and the rate of death from heart disease are lower (Sizer & Whitney, 1997).

The American Heart Association (2000) recommends limiting the total fat intake to less than 30% of calories, and that the cholesterol intake from food be limited to 300 mg a day. Other dietary factors that can lower blood cholesterol include fibers from cereals, fruits, legumes, and other vegetables (Sizer & Whitney, 1997).

A major dietary intervention for reducing blood pressure is reducing sodium intake. Instead of using salt to season food, one should try cooking with herbs and spices. Fresh or most frozen products are optimal and "no added salt" canned goods
Interventions should also be apart of the everyday diet. There are other dietary factors that can help reduce blood pressure, such as adequate potassium, magnesium, and vitamin C consumption, which can help stabilize blood pressure (Sizer & Whitney, 1997).

While large amounts of alcohol can be detrimental and increase blood pressure, alcohol in moderation has been shown to be protective against CAD. A glass of red or white wine daily can reduce the incidence of coronary events. Also smoking cessation can decrease a person’s risk for CAD by as much as 50% (Futterman & Lemberg, 2000).

For people who are obese and hypertensive, a weight loss of as little as 10 pounds may significantly lower blood pressure. The same physical activity can increase blood HDL and lower LDL. Physical activity also changes the hormonal climate in which the body does its work. Also, physical activity of the right intensity, frequency and duration can increase the fitness of the heart and lungs, which may help protect against heart disease even if a person has other risk factors (American Heart Association, 2000). Exercise reduces stress, and thereby stress hormone secretion, and this lowers blood pressure. It redistributes body water, and it eases transit of the blood through the peripheral arteries (Sizer & Whitney, 1997).

While this seems like an easy thing to do, sustained adoption of a therapeutic diet can be difficult; only 50% of
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Patients achieve success in the short term and fewer than 20% maintain dietary changes in the long term (Conrad, Gainville, & Raine-Travers, 2000). This makes patient teaching by a healthcare professional very important. The patient needs education on how to be realistic when trying to change eating habits. Permanent healthy eating habits result when changes are made gradually and may take one to two years to develop.

Exercise is not only attributed to weight loss, but the strengthening of the myocardial muscle. Many exercise adaptations are related to skeletal and cardiac muscle changes, increased capillary density, and increased muscle strength (Thompson, 2001). Exercise increases blood flow through the working muscles and the heart forcing the lungs and the heart to work more efficiently. The patient needs to follow the exercise guidelines provided by the doctor, however, general exercises that help the heart and the body work better include: walking, hiking, jogging, bicycling, swimming, cross-country skiing, jumping rope, and rowing.

While exercise programs are just as hard to adhere to as diet programs, it is important to tell the patient that a little goes a long way. Minor activities such as walking up the stairs instead of taking the elevator, parking farther away, and walking instead of driving to short destinations are all easy ways to get some exercise every day.
For some patients, diet and exercise cannot manage their disease alone. Medication therapy must also be used in conjunction with their lifestyle changes. Medical treatment will depend on the nature of the disease and the general health of the patient. These medications can help treat the symptoms of CAD and perhaps slow down the progression of the disease.

In treating angina, nitrates are the most effective choice for relieving acute attacks. Nitrates act directly on vascular smooth muscle to promote vasodilation (dilation of the vessels). Nitrates dilate coronary arteries and collateral arteries, which improve blood supply to the ischemic areas. This treats the symptoms of angina (Hopfer-Deglin & Hazard-Vallerand, 2001). Nitroglycerin comes in the form of sustained-release oral tablets, transdermal patch, a spray, which is administered under the tongue, and a topical ointment. All of these forms are directly absorbed into the bloodstream (Crosby, Hamilton, & Moore, 1998).

Beta-blockers (e.g. Metoprolol/Lopressor, Atenolol) are another form of medication used to treat angina. They are effective in treating stable angina, not vasospastic (Prinzmetal) angina (Crosby et al., 1998). Beta-blockers are used to control heart rate and decrease oxygen demand on the heart. They are popular because two decades of clinical data support their safety and efficacy. Approximately 15 different
beta-blockers are approved to treat hypertension, angina, cardiac arrhythmia, MI, migraines, anxiety, and glaucoma (Palatnik, 2001).

Beta-blockers reduce anginal pain by decreasing cardiac oxygen demand. This is accomplished primarily through the blockade of beta-1 receptors in the heart, which decreases the heart rate and the force of the contraction of the heart. They can also reduce oxygen demand by causing a moderate reduction in arterial pressure (afterload) (Crosby et al., 1998).

Calcium channel blockers work in two different ways. Examples such as diltiazem and verapamil decrease the heart rate and cause coronary artery vasodilation (Palatnik, 2001). The decrease in heart rate reduces the oxygen demand of the heart and the coronary artery vasodilation improves oxygen flow to the myocardium. For example, in Prinzmetal angina, the vasodilation caused by calcium channel blockers prevent the spasms of the arteries and increases the oxygen supply to the heart (Hopfer-Deglin & Hazard-Vallerand, 2001). Other calcium channel blockers such as amlodipine and felodipine dilate peripheral blood vessels but do not affect heart rate or the force of the contraction of the heart (Palatnik). By dilating the peripheral blood vessels, calcium channel blockers are reducing the resistance that the heart has to overcome to eject the blood into the body.
Another drug that affects the amount of blood ejected by the heart is digoxin. The use of digoxin is indicated for heart failure because it can reduce the symptoms, increase exercise tolerance, and decrease hospitalizations. The primary effect of digoxin is to increase the contractile force of the heart, which in turn causes an increase in cardiac output (Crosby et al., 1998). This drug is able to improve the efficacy of the heart without increasing its oxygen demands. It is also a strong chronotropic drug, meaning it decreases the heart rate which decreases the oxygen demands of the heart (Hopfer-Deglin & Hazard-Vallerand, 2001).

Also used in the treatment of heart failure and hypertension are angiotensin converting enzyme (ACE) inhibitors (e.g. captopril, enalapril, fosinopril, lisinopril, and moexipril) (Crosby et al., 1998). ACE inhibitors stop the conversion of angiotensin I to angiotensin II, which dilates the blood vessels, reduces sodium and water retention, and reduces intravascular fluid volume (Palatnik, 2001). By reducing the amount of fluid within the vessel walls, ACE inhibitors decrease blood pressure and in turn, decrease the amount of work the heart has to overcome to eject blood into the system. New literature also states that ACE inhibitors help prevent remodeling. This term refers to the compensatory development of hypertrophy of the unaffected left ventricle. This hypertrophy
Interventions attempts to compensate for the loss of function in the infarcted area (Marek et al., 1999).

Diuretics work by the same principle. Most diuretics work by increasing urine output by blocking the reabsorption of sodium and chloride in the kidneys. Diuretics are classified into four different categories depending on what area of the kidneys they affect. However, the outcome is the same for all four categories: intravascular volume is decreased due to the excretion of sodium and water (Palatnik, 2001).

Quite frequently, diuretics are used in conjunction with cardiovascular drugs. This is very important when digoxin is being used. Thiazide diuretics and loop diuretics promote the loss of potassium instead of sodium. Decreased amounts of potassium in the blood can cause digoxin to be toxic to the heart. When digoxin and these diuretics are used concurrently, serum potassium levels must be monitored and maintained within a normal range (3.5 to 5.0 mEq/L). If hypokalemia (low potassium) develops, potassium levels can be restored with potassium supplements, a potassium sparing diuretic, or both (Crosby et al., 1998).

Another drug that does not work directly on the heart, but has an impact on the oxygen supply to the heart, is a simple over-the-counter drug that is in practically every medicine cabinet: aspirin. Among the many useful effects of aspirin, it
can suppress platelet aggregation. Platelets are cells within the blood that adhere to a surface when there is a lesion in the tissue. By suppressing the platelet aggregation, it keeps a thrombus from forming in the vessels. The same method applies for a person who has atherosclerosis. The plaque causes lesions to form on the inside walls of the vessels, which attract the platelets to the area. This could cause complete blockage of the vessel resulting in a MI. By suppressing platelet aggregation, aspirin reduces the chances of this happening. Other drugs that work in the same manner are anti-platelet drugs. Examples of these drugs include Plavix and Clopidogrel (Crosby et al., 1998).

For some people, the progression of their disease has moved so far along, that they have no other choice but surgical interventions. There are several different types of surgical treatments with the least invasive being catheterization and the most serious being heart transplantation. Each method is targeted at reversing the disease and treating the failure of the heart. After the procedure, it is up to the patient and the health care staff to help the patient return to optimal functioning before they were diagnosed with the disease.

If there is a blockage in one of the heart vessels that is causing angina, and is significant enough that it is blocking blood flow and could lead to something more serious, a percutaneous transluminal coronary angioplasty (PTCA) may be recommended. This procedure is similar to heart catheterization and performed by a cardiologist.
The patient is sedated and a local anesthetic is injected at the arterial insertion site. After insertion of a sheath in the artery, a guiding catheter is positioned in the opening of the coronary artery. A thin flexible guide wire is floated into the vessel and through the narrowing. A catheter with a balloon at the tip is then advanced over the guide wire. The balloon catheter is positioned next to the atherosclerotic plaque. The balloon is inflated, which compresses the plaque. When the balloon is withdrawn, blood flow is reestablished through the widened vessel (Marek et al., 1999).

In a very similar procedure, a stent can be placed at the narrowing in the coronary vessel. A stent prevents abrupt vessel closure and provides support for the vessel wall preventing initial elastic recoil. It also improves short-term and long-term vessel patency (Futterman & Lemberg, 2000). A coronary stent is a small, slotted metal tube mounted on a balloon catheter. The catheter is inserted in the same way as it is done in PTCA. Once the catheter is in place, the balloon is inflated and the stent is deployed and remains in the coronary artery as a scaffold. The balloon catheter is removed, and over the next three weeks, tissue grows around the stent making it apart of the vessel lumen (Marek et al., 1999).

There are other procedures that can be used to treat coronary artery occlusion. However, these methods are only beneficial for certain types of lesions formed by plaque. Atherectomy is also a procedure where a catheter is placed inside the coronary artery. The basic concept associated with
using rotational atherectomy to treat coronary stenosis is differential cutting of the plaque. Differential cutting allows removal of hard (non-compliant) material without damage to softer (compliant) tissue. Differential cutting is analogous to shaving: injury of the elastic, compliant skin is avoided by diverting the skin under the razor’s sharp edge, whereas the non-compliant material is removed by the sharp blade. (Barbiere, Morgan, Thorbs, & Wayland, 2000).

PTCA, stent placement, and atherectomy are not permanent remedies for CAD. After completion of the procedure, patient teaching needs to occur. A health care professional needs to talk about the lifestyle changes that are needed to maintain the health of their heart. If the patient does not adhere to a change, they may be back in the hospital, and the procedure might not be that simple.

There are many people who never know they have a problem with their heart until they end up in the emergency room because they have had a MI. The most common procedure for these patients is a coronary artery bypass graft (CABG). In 1995 there were 573,000 CABG surgeries performed in the United States at a cost of $44,820 per surgery (Rumsfeld, Ma-Whinney, McCarthy, & Shroyer, 1999).

In a CABG surgery, the surgeon attaches an artery or a vein graft to the coronary artery beyond the areas of blockage. This creates a bypass around the obstruction, allowing blood to flow freely again. The two most commonly used vessels are the saphenous vein and the internal mammary artery (arteries located
behind the breastbone). The internal mammary artery usually remains patent longer. This is due to the fact that arteries are bigger than veins and they have a higher-pressure system. When the internal mammary artery is used, it is detached from where it inserts into the chest and is sewn into the coronary artery beyond the blockage (Marek et al., 1999).

The risks and benefits need to be evaluated and so does the anatomical structures of the lesions. The surgeon should speak with the patient and the family to collaborate on the intervention process. Although CABG surgery is not curative because the grafts can also occlude, it improves the quality of life in many patients (Marek et al., 1999).

Heart transplantation is the last resort in interventions for CHF. Although heart transplantation is just another surgical procedure, and does not differ much from open heart surgery (i.e. CABG), several factors affect the vulnerability of patients awaiting a donated heart.

Donor availability is a serious problem with cardiac transplantation, and the waiting period may be prolonged. As the patient’s condition deteriorates, extended hospitalization may be required until a suitable donor can be found (Marek et al., 1999). The waiting period for heart transplantation is extremely stressful and demanding for both patients and their families. This intense period affects patients’ psychosocial well-being, and this situation affects their families’ adjustment to having a chronically ill member who is at risk of dying any time (Tahan, 1998).
CONCLUSION

Coronary artery disease is the number one killer in America. It costs billions of dollars each year to treat and hospitalize patients with this disease. The amazing reality of this disease is that it is completely preventable. With proper diet, exercise, and management of diseases such as diabetes, the heart will remain healthy for a long time.
References


MAY 16, 2001

Today was my first day of orientation at St. Joseph’s Medical Center in Tacoma, Washington. It was very general due to the fact there were people from all departments who were new like I was. It was a day filled with paperwork, immunizations, and tests.

All in all, I am very excited because everyone seems very nice and it is a comfortable atmosphere.

MAY 23, 2001

Today was the last day of my three-day workweek. Since I am working in critical care, which at St. Joe’s includes three ICUs and three PCUs, I work three twelve-hour shifts a week. This is going to take some getting used to! Seven a.m. to seven-thirty p.m. is a very long day, especially when I have to get up at five o’clock in the morning!

I can tell that this is going to be such a great experience. It has been very overwhelming, because there is so much information to learn, and so much work to do. I am responsible for taking a patient’s chart and transcribing doctor’s orders into the computer. This is very time consuming for me because I am still learning all the different codes for the many lab tests, diagnostic tests, special diets, etc. In the cardiac intensive care unit, it is even more stressful because there are tests that need to be ordered STAT as soon as the
patient arrives on the unit from the O.R. The really good care-assistants even know the tests to order that are specific to the surgeon. It is my goal to be like that.

In addition to this, it is my responsibility to prepare the paperwork for a patient who has orders to be discharged or transferred to a different floor. This is probably the most confusing part of my job because of the complexity of insurance companies. Each insurance company has different paperwork that needs to be faxed to them for a discharge. If it is ordered, home health or rehabilitation also need to be arranged. Follow-up doctor's appointments are made for post-open heart patients, and they need to be charged for there stay. It is my responsibility to make sure that they are charged for certain items that are used on the unit, and that they are charged for the proper room.

Along with all this I help the nurses get vital signs on their patients, help with bed-baths, run to the lab with specimens, run to the blood bank for blood, empty the linen carts, pass trays, feed one-to-one feeders, and occasionally do a one-to-one with a patient. I also perform duties that I have been trained to do in school, such as insert a Foley catheter, CPR, etc.

My very first day, which was Monday the twenty-first, was in the ICU. I was assigned to a care-assistant who started my training. She taught me all about the computer, and I caught on quick. The most exciting part of the day was near the end, when a code 4 was called overhead. A code 4 is meant to alert
the critical care staff and the ER staff that a patient has stopped breathing and their heart has stopped. The location was one of the PCUs on the floor that I was working on. One of the nurses grabbed me and we ran over there. Of course I could not do anything for the moment, but it was the first time that I saw a real code. My heart was pounding in my chest as I watched the doctors and the nurses revive this elderly woman.

The second day was in the cardiac ICU. It is a very stressful, fast paced place to work, but it made the day go by fast. The care assistant that I was working with was very encouraging and kept telling me that I was doing a great job. It was great because the nurses let me stand in the room when the heart patients came back from the O.R. Even though I was not able to do much other than empty the Foley and hand things to the nurses, it was such a great experience because I got to observe.

The third day, and my last for the week, was today. Again I was in the cardiac ICU, which was good for me so I could really learn that unit. It was more learning but I feel like I am starting to get the hang of it. I had the opportunity to watch a cardiologist perform a transesophageal echocardiogram (TEE). This is a procedure where they use conscious sedation on a patient, numb the throat, and stick an endoscope down the esophagus to retrieve a picture of the heart. The doctor was looking to see if the woman had a defect in her heart that was allowing blood clots to pass through the heart and into the brain, causing her to have a stroke.
I think this is going to be a great learning experience for me. I hope to take away so much from this experience. It is going to help me gain confidence in my skills, and it is going to help me apply what I have learned in school in a clinical setting.

MAY 30, 2001

This week was a short week compared to last week. On Monday, Tuesday, and Wednesday I had in-house orientation. This is the hospital's main three days of orientation. It is interesting because they have a thing called "Spirit at Work." It is all about taking pride in your work and that every employee in the hospital is important. We did this exercise that showed us that we are all connected, and without the others to catch us, we would fall. The hospital also taught us the four values they instill in all of its workers: integrity, compassion, excellence, and reverence. There was also orientation to security, violence in the work place, proper body mechanics, a computer class, and activities such as updating shots and CPR cards.

JUNE 6, 2001

This week was more orienting on the floors. I spent all three days on the PCU's practicing everything I have been learning under the watchful eyes of great mentors. The difference between the PCU and the ICU, is there is a lot more patient care involved in the PCU. The patients are less acutely
ill, so it is not too scary to help take their vital signs, get them up to the bathroom, and help with other activities of daily living. I really like working here, everyone is so nice and are always willing to teach me. I learn so much everyday just by being around the patients, the terminology, and the practice.

Wednesday, which is today, was my last day of orientation before I am set out on my own next Monday. This by far was the most exciting day I have had since I have been here. I was working in one of the PCUs when a code four was announced over the PA system. I have a very good friend who has been a nurse at St. Joe’s for almost two years. She grabbed me and said, “Let’s Go!” I was so shocked, but we ran up four flights of stairs and were the first to arrive on the scene. She started to prepare the patient to shock him, and I ran and got supplies that were needed to set up for anything else that the doctors and nurses might need for a code. To me, it was sheer chaos, but to the doctors and nurses, it was all a routine. Half way through the code, someone needed to relieve the nurse who had been doing chest compressions for CPR. My friend grabbed me and pulled me down to the floor where the patient was lying, and I started to do chest compressions. It was my first time to perform CPR on a real person. The patient ended up dying and even though it was a good experience for me, I never get used to seeing the loss of life.

June 13, 2001

This week was very quiet. I spent my three days of work in
It was my first week alone, I was done with my training. It was really overwhelming, however I survived. My co-workers are really great because they will take the time to come and help me if I get behind or stuck. Even though I am a little scared to be on my own, it is nice because now I am getting into my own routine, which will help me remember everything I have to do. Before I was always confusing myself because I was trying to do things the way everyone else did it. It is really teaching me organizational skill which will benefit my nursing career in the future.

June 24, 2001

This was the first time that I had to work on the weekend. It was interesting to see the difference in activity as compared to the weekday, especially Monday. The whole atmosphere is not as tense, unless a trauma case comes in (which they often do on the weekend). We had one trauma this weekend which was especially sad. A nineteen-year-old boy tried to commit suicide and was unsuccessful. He will basically have no brain function for the rest of his life. It is times like this when I understand people who say do not work full time in the ICU, because you will get burned out.

July 1, 2001

After having the majority of the week off, I worked another weekend. I take back everything I said about the weekends being
less busy than the weekdays. I was proven wrong this weekend, especially on Saturday. The day was off to a bad start because the night-shift care assistant did not finish all of her duties, so I had to do them for her. That right away put me behind. Also right off the bat, there was one discharge and one patient who needed to be taken down to surgery.

Halfway through the day, one of the nurses noticed that one of her patient’s heart rate was slowly going down all morning. She called his cardiologist who decided given the history of illness in this patient, that he was going to put a pacemaker in. However, by the time the doctor reported to the floor, the patient was too unstable to be moved. Therefore, the pacemaker had to be put in while the patient was still on the floor. The x-ray technicians had to come up to the floor with all of their big, bulky equipment to assist the doctor. One of the nurses told me to go watch and that she would watch my job for me.

It was very interesting to watch this pacemaker be put in. The patient was hooked-up to a monitor and given a sedative. He was also given a local anesthetic where the wires were going to be put in. The x-ray technician provided the visual aid so the cardiologist could monitor where the wires were being placed. After the procedure was finished, the patient’s heart rate went back up to a normal range, and the patient was then transferred to the ICU.

The day continued to go very quickly because there was so much to do. And even though Saturday was very hectic, Sunday still proved me wrong as well. It was just a day that
everything seemed to go wrong. It was as if everything that had happened on Saturday overflowed into Sunday. At least the days went by fairly quickly and I got to see a variety of things that helped improve my experience and education.

July 8, 2001

This week I was scheduled to work the 3rd, 5th, and the 8th. However, I had my first low-census this week. This is where there are too many staff scheduled for the amount of patients on the floor. I was put on stand-by, which is where I can be called in if they need me.

The other two days I worked in the PCU, and it was pretty uneventful. I just keep concentrating on improving my organizational skills, working on my therapeutic communication, and working on my nursing skills. I ask questions any opportunity that I can, and everyone is very supportive of helping me.

July 12, 2001

This week I worked on the tenth and the twelfth. I took a daring leap and worked both days in the cardiac ICU. This was daring because it is the most stressful place to work, and I had never worked there by myself before. On the tenth we had three open hearts that day. Of course two of them came back within 5 minutes of each other. This was really stressful for me because there is a number of things that you have to do immediately
after the patient returns. This includes ordering STAT labs, putting the chart together, and making sure the nurses have all the support they need.

We had a situation with the second heart that came back. She was bleeding excessively from her chest tubes, and the nurse was constantly having to hang another pint of blood. I was running back and forth from the floor to the lab to get the blood she needed. After 8 units of blood, it was clear that something else was going on, and the nurse sent the patient back to surgery. While this was going on the third heart patient came back from surgery. You can imagine my stress!

However, I feel that I did really well because I work well under pressure. The more I have to do, and the more I have to think about, the more efficient I am. At the end of the day, the nurses were very appreciative of all my efforts, and it made me feel really good about myself. When I came back to work on the twelfth, one of the nurses who had worked that day told me that she nominated me for the candy bar award, which is part of the spirit at work program, for all of my wonderful help that day. That meant so much to me, and it really boosted my confidence.

July 15, 2001

I have the next two weeks off because I am getting married on the 21st and I am going on my honeymoon for a week.
The 1st was my first day back from my vacation. It was nice because I was called in to do a one-to-one with a patient who was very combative when she came into the ER. They do this so the patient will not have to be in restraints. I am responsible for all of the patient care except for medications. It was a good experience because I was really working on my patient care skills.

The second day back, I was called to help out on the oncology floor because they were short handed. I did a lot of patient care there as well. I was responsible for all of the vital signs of every patient, along with baths, feedings, and toileting. I also spent my third day here as well.

I started my weekend by doing a one-to-one in the PCU. This was a patient who fell down a flight of concrete stairs and was going through alcohol withdrawal and was very agitated. On Friday the nurse gave him medication to help with his agitation and he was very sleepy for most of the day. However, on Saturday no medication was given to him because they did not want him to be sedated when the doctor came to talk with him. He was very agitated because he could not get out of bed, because he could not even sit-up without falling over, let alone stand on his own.

To help take his mind off of being stuck in bed, we started a conversation. It was going really well until all of a sudden,
he tried to leap out of bed. He started screaming, yelling and throwing his arms and legs around. A staff member came to help me calm him down while another staff member called a code orange over head. This is a code for a patient or someone else in the hospital that is acting out violently towards hospital employees or other patients. Security came rushing in, but before anyone could get a handle on the situation, the man hit another care assistant and me. It was very frightening because things like this happen all of the time to nurses. It really made me see how vulnerable I can be at work.

The patient was put into restraints and I was taken out of the room to debrief the situation with a psychiatric nurse who came to restrain him. She made me feel better about what happened, and she helped me turn it into a positive learning experience. She let me know that it was not my fault that this happened, and I really saw the importance of having boundaries with patients.

August 16, 2001

This week I had another one-to-one with a suicidal patient. She had tried to kill herself by overdosing on some drugs and alcohol. Most of the time she slept, however I was able to spend time talking with her. She was very nice and very open about why she tried to kill herself. This was not her first attempt, and she was going to go to the psychiatric unit once she was stabilized on our floor. She was going voluntarily, which was a good sign.
Today I had my last day of work before I start to go back to school. It was a very good day, I spent it in the PCU. It was pretty uneventful, however there were two nurses and two care assistants as opposed to one care assistant and three nurses. This meant that I did a lot of patient care. It was a great way to end my summer there. I have made a lot of new friends who mean a lot to me, and I hope to work with them in the future.

August 22, 2001

Today was the day that I have been waiting for my whole summer, I got to watch an open-heart surgery. It was the most amazing thing I had ever seen. I was there from the moment the patient was sedated to the transfer of the patient to the cardiac ICU. Once the patient had been prepped and the chest was open, I was allowed to stand at the head of the bed with the anesthesiologist. I had a perfect view of everything. It was so amazing to see everything I had learned about in textbooks, actually happen right before my eyes. I watched this person’s heart beating right inside of her chest. I saw the surgeon isolate the internal mammary artery and the saphenous vein and then attach them to the heart to bypass the occlusions. It was so amazing. The procedure took approximately four hours and then I was allowed to help transfer the patient to the ICU. It was by far the most educational, exciting experience of my career this far. The surgeon was also very proud of me for “staying vertical” in the operating room! It was a wonderful
way to end my summer.