Dilated Cardiomyopathy: A Literature Review

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Abstract

Dilated Cardiomyopathy (DCM) is one of the three main types of cardiomyopathies. Patients who have this disease show a variety of symptoms and can be assessed by many tests including the use of medical imaging. There are many different possible causes of this disease and in some cases the cause is unknown. The rising technology of medicine and medical imaging can help diagnose DCM sooner and improve treatment and therefore the quality of life of those diagnosed.
Introduction

The heart is one of the most vital organs in the human body and many different diseases can attack it. There are a wide range of cardiovascular diseases including diseases specifically of the heart muscle, or cardiomyopathy. There are three different types of cardiomyopathies; dilated, hypertrophic and restrictive. Dilated is the most common. Medical imaging plays an important role in diagnosing and treating this disease.

Literature Review

Dilated Cardiomyopathy

There are two systems of the heart, mechanical and electrical. These two systems perform all of the heart’s major functions. The mechanical system of the heart is responsible for pumping blood throughout the whole body. The electric components of the heart produce a rhythm for the heart to contract and relax, to ensure the blood is being pumped correctly. The simple anatomy of the heart performs the complex function of transporting blood to and away from all tissues of the body (Marieb & Hoehn, 2010).

When the hearts major function is to pump blood through the body the possible problem of not being able to perform this function correctly arises, also known as a homeostatic imbalance of cardiac output (Marieb & Hoehn, 2010).

“When the pumping efficiency (cardiac output) of the heart is so low that blood circulation is inadequate to meet tissue needs, the heart is said to be in congestive heart failure (CHF). This progressively worsening condition reflects weakening of the myocardium by various conditions which damage it in different ways” (Marieb & Hoehn, 2010, p. 687).
DCM is one of the leading conditions that causes a decrease in cardiac output and is a cause of heart failure (Marieb & Hoehn, 2010; Kasper & Knudson, 2010; Cohen 2010).

DCM is a condition where the heart muscle becomes enlarged and weakened, and cannot efficiently pump blood throughout the body (Cohen, 2010). A portion of the myocardium, or heart muscle, is dilated. The word cardiomyopathy is broken down by Cohen (2010). He states “Cardiomyopathy is a weak or abnormal heart muscle: cardio (heart), myo (muscle), and pathy (disease process) = heart muscle disease” (p.135). Patients with this condition experience a wide range of symptoms and can be treated in several different ways.

According to Kasper and Knudson (2010) an important statistic about the heart is the heart’s power to pump blood or ejection fraction. A normal ejection fraction is not 100 percent but rather between 55 and 65. They also state “A reading much below 50 percent is considered abnormal and indicates a diagnosis of dilated cardiomyopathy” (p. 139).

**The Cause of DCM**

The cause of DCM is often unknown but there are possible heart problems that can be a cause. Hoehn and Marieb (2008) state, “The cause of this condition (dilated cardiomyopathy), in which the ventricles stretch and become flabby and the myocardium deteriorates, is often unknown” (p. 687). On the contrary Cohen (2010), a physician providing information for patients living with heart disease, lists many possible causes of DCM. He states, “There are many causes of dilated cardiomyopathy: ischemic, idiopathic, hypertensive, valvular, chemotherapy/radiation induced, peripartum (induced by pregnancy), alcohol related or inherited” (p.136).

**Symptoms**
“People with cardiomyopathies may be symptom-free or highly symptomatic” (Cohen, 2010, p. 135). There is a wide variety of symptoms experienced by people and a range of signs doctors assess (Cohen, 2010; Kasper & Knudson, 2010). One thing that is consistent is that not one person dealing with this disease experiences the exact same symptoms.

Most common symptoms of DCM are those experienced by those who have congestive heart failure (CHF) (Cohen, 2010). Symptoms of CHF or DCM stated by Cohen (2010) include, “shortness of breath, leg swelling, decreased exercise tolerance, fatigue, light-headness, dizziness, confusion, coughing or wheezing, weight gain, and palpitations” (p. 133). Another list of symptoms groups symptoms into four classes “Class I: Patients with no limitation of activities; they suffer no symptoms from ordinary activities. Class II: Patients with a slight limitation of activity; they are comfortable at rest and with mild exertion. Class III: Patients with marked limitation of activity; they are comfortable only at rest. Class IV: Patients are symptomatic even at rest, and physical activity brings on discomfort” (Cohen, 2010, p. 132). Physiologic symptoms are explained by Marieb and Hoehn (2010). They state:

The heart’s attempts to work harder result in increasing levels of Ca+ in the cardiac cells. The Ca+ activates calcineurin, a calcium-sensitive enzyme that initiates a cascade which switches on genes that cause heart enlargement. CO (cardiac output) is poor because ventricular contractility is impaired, and the condition progressively worsens (p.687).

Therefore when the heart’s pumping activity is increased the muscle must increase in mass to keep up with the work load. After the muscle mass increases the heart must pump even harder because of increased heart muscle to feed and the cycle continues causing the condition to
worsen. Eventually the heart can be flooded by its own blood that it cannot get rid of. The heart is therefore congested, and the heart suffocates and fails (Marieb & Hoehn, 2010).

**Using Medical Imaging to Diagnose DCM**

Because of the diversity in severity of symptoms experienced by those with DCM, this disease is not always diagnosed (Cohen, 2010; Kasper & Knudson, 2010). Some patients may even be diagnosed by a routine electrocardiogram (EKG) when seeing a physician for another reason. When abnormalities are found the patient is sent to have an echocardiogram to further investigate EKG results (Kasper & Knudson, 2010). On the other hand patients visiting a physician because of experiencing DCM symptoms earlier discussed are also generally diagnosed by way of an EKG, echocardiogram, or chest radiograph, and most instances the combination of all three.

Often times the initial clinical test that suspects DCM is a chest radiograph (Hodler, Schulthess, & Zollikofer, 2007). An original sign of DCM is cardiomegaly shown on a chest radiograph. (See Figure 1) Electrocardiogram (EKG) records the electric activity of the heart and assesses if heart rhythm is normal and can tell you the type of arrhythmia (Marieb & Hoehn, 2010). Patients with DCM generally have bradycardia. Echocardiogram, or sonography of the heart, is a way to visualize the heart in real time and measure ejection fraction (Kasper & Knudson, 2010) An echocardiogram can also find thickening of the heart muscle and bradycardia (Cohen, 2010).

Echocardiography is the most common imaging procedure used in cardiovascular medicine and has become the mainstream option for assessing the structure and function of the heart (Laya et al., 2006). Its use allows physicians to visualize cardiac structures, as well as
evaluate regional wall motion at rest and during stress. Echocardiograms are very important when diagnosing DCM (Laya et al., 2006).

During surgical procedures to implant devices using x-ray guidance for placing catheters and leads with contract material decreases surgical risks and can minimize errors. This is yet another way medical imaging can aide those diagnosed with DCM. Studies have been done to assess the use of contrast, an article about results states “Contrast-guided axillary vein puncture is becoming increasingly popular, as it is safe, rapid, widely applicable, and has the potential of reducing the incidence of lead failure, though long-term observations are still pending” (Burri, Sunthorn, Dorsaz & Shah, 2005, p.282).

**Magnetic Resonance Imaging**

Magnetic resonance (MR) imaging is becoming a fundamental way of imaging the heart. With increases in technology MR imaging is faster and more capable of assessing heart anatomy and function (Hodler et al., 2007). In a study done investigating the accuracy of chest radiographs in diagnosing congenital heart disease Laya et al. (2006) states “Radiologists play an important role in the evaluation of these patients, utilizing various imaging modalities such as chest radiographs, angiography, CT, and MRI” (p.678). Hodler, Schulthess, and Zollikofer state “Magnetic resonance imaging is a noninvasive tool that has a high degree of accuracy and reproducibility in the visualization of left and right ventricular morphology and function.” (p.143).

MR imaging presents the option to use contrast enhanced imaging, which is also very helpful in assessing DCM and giving aide to cardiac biopsies. When imaging the heart being able to differentiate between healthy heart muscle and scar tissue is important in diagnosis and treatment, MR imaging is valuable in assessing this as well (Hodler et al. 2007).
Treatment Options

Medical or device treatments are both options based on ejection fraction and heart failure symptoms (Cohen, 2010). Treatment devices have a variety of possible choices. If the patient has met a level of severity the physicians can decide to implant a pacemaker (PM) or implantable cardioverter defibrillator (ICD). Device implants are generally used to pace the heart or shock it back into rhythm if heart becomes arrhythmic (Cohen, 2010). Physicians can access recorded information through a remote control that communicates or downloads the information from the implanted device to a computer in the physician’s office. New technology is making the internet an available source to gather information off the devices.

Prescription medications are an important option for patients with DCM. Patients with DCM or CHF are treated with beta blockers, angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor blocker (ARB) (Cohen, 2010). Beta blockers help the heart beat slower to conserve heart energy and ARB and ACE inhibitors decrease blood pressure which decreases the work load of the heart (Cohen, 2010).

One other upcoming option of medical therapy is Cardiac Resynchronization therapy (CRT). Blom (2009) states “CRT is a medication therapy used to stop worsening of muscle disease and hope to reverse damages to the heart” (p.67). It is a new upcoming type of medical therapy and in the limited studies done has shown an improvement in ejection fraction. CRT is an option before turning directly to a surgical implant. Blom (2009) also stated “The best candidate for CRT appears to be the patient with CHD or dilated cardiomyopathy” (p.67).

Case Report

A 19 year old collegiate soccer player was having difficult time breathing while running. She had played her freshman year of collegiate soccer the previous year and was training for the
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miles test she was required to pass in a couple weeks prior to starting her sophomore year of soccer. She was unusually easily fatigued and couldn’t catch her breath. Her mom took her to a pulmonologist wondering if the symptoms were asthma. A chest radiograph revealed cardiomegaly, after which the pulmonologist ordered an echocardiogram. The next day after the echocardiogram the doctor advised her that playing collegiate soccer the following season was not a good idea. After the news her mom took her for a second opinion to a cardiologist.

The cardiologist ordered an electrocardiogram (EKG) to be taken and compared results with the previous echocardiogram and diagnosed her with DCM. The patient was experiencing fatigue because of left ventricle failure or systolic dysfunction. When originally diagnosed her ejection fraction was between 20-30% and is relatively the same today, three years later. She began medical therapy and was prescribed 37 mg of carvedilol twice a day, 25 mg of stironolact once a day, 125 mg digoxin once a day and 5 mg of lisinotril once a day. When she first started taking carvedilol the doses were slowly increased because of side effects such as light headiness and dizziness. She has been on the same medications since diagnosed (Irvin, 2012, Personal Communication).

She was never able to play competitive soccer again and her lifestyle changed dramatically. She had to considerably decrease sodium and red meat intake. Her exercise was limited severely. Pregnancy risks extremely increased. Her condition has relatively remained the same.

The physician could not define a specific cause, and there was no evidence it could be hereditary. He had a theory that it was caused by a virus that attacked her heart. When the patient was in her senior year of high school, eighteen months prior to being diagnosed, she dealt with the oral fungus called thrush. She had sores in her mouth and many high fevers. They believe
this could have attacked her heart and caused DCM. They suspect her symptoms of DCM were asymptomatic until this point.

Six months after being diagnosed the patient had surgical implantation of a cardiac resynchronization therapy device with two leads, one to her left ventricle and one to her right atrium. (See Figure 2) Her device contains a monitor that can record heart rhythm and any arrhythmia, a pacing device and a defibrillator. Within six months of receiving her implant the patient’s heart became severely arrhythmic, enough that the defibrillator portion of her device had to shock her heart back into proper rhythm. Since then she has lived with her condition as normally as possible while continuing to take medication and see her cardiologist every six months for routine follow ups. Doctors estimate she will need a new device within seven years.

**Discussion**

DCM is one of the most common causes of congested heart failure. Symptoms vary depending on the severity of the condition. Medical imaging is a great source for physicians when diagnosing and treating this condition. EKG, echocardiogram, basic chest radiographs are the first line of defense. MR imaging is becoming a streamline way to image the heart of those with DCM. Treatment options include medications or device implants. The cause is generally unknown but can sometimes be attributed to other heart defects. In conclusion, there has yet to be found a cure or complete reverse to this disease. Until then physicians will continue to treat those with this disease using prescription medication and implantable devices and hope to improve or maintain quality of life of those diagnosed with DCM.
**Figures**

**Figure 1.** Chest radiograph showing signs of cardiomegaly, or enlargement of heart.


![Chest radiograph](image)

**Figure 2.** Boston Scientific, cardiac resynchronization therapy device.

Note. The following image was used by permission from Ashley Irvin, personal interview, November 2012.

![Cardiac device](image)
References


