

A REVIEW ON PHARMACOTHERAPY AND MANAGEMENT FOR HEART FAILURE

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ABSTRACT: *Heart failure (HF) often called Congestive heart failure (CHF) is generally defined as the inability of the heart to supply sufficient blood flow to meet the needs of the body. Common causes of heart failure include myocardial infarction and other forms of ischemic heart disease, hypertension, valvular heart disease, and cardiomyopathy. The term "heart failure" is sometimes incorrectly used to describe other cardiac-related illnesses, such as myocardial infarction (heart attack) or cardiac arrest, which can cause heart failure but are not equivalent to heart failure. Heart failure is associated with significantly reduced physical and mental health, resulting in a markedly decreased quality of life. A systemic review is need of the hour to understand the situations, circumstances that cause the failure of the heart. On the other hand the management plays a vital role in combating the disease. The article describes about the classification and pharmacotherapeutical management of heart failure.*

Key words: CHF, Myocardial Infarction, Management, Heart, Pharmacotherapy.

INTRODUCTION:

Heart failure is a clinical syndrome caused by the inability of the heart to pump sufficient blood to meet the metabolic needs of the body. Heart failure can result from any disorder that reduces ventricular filling (diastolic dysfunction) and/or myocardial contractility (systolic dysfunction). The leading causes of heart failure are coronary artery disease and hypertension. The primary manifestations of the syndrome are dyspnea, fatigue, and fluid retention. Heart failure is a progressive disorder that begins with myocardial injury. In response to the injury, a number of compensatory responses are activated in an attempt to maintain adequate cardiac output, including the sympathetic nervous system, increased preload, vasoconstriction, and ventricular hypertrophy/remodeling. These compensatory mechanisms are responsible for the symptoms of heart failure and contribute to disease progression.

In spite of the way it sounds, heart failure does not mean that the heart suddenly stopped working or that you are about to die. Rather, heart failure is a common condition that usually develops slowly as the heart muscle weakens and needs to work harder to keep blood flowing through the body. Heart failure develops following injury to the heart such as the damage

caused by a heart attack, long-term high blood pressure, or an abnormality of one of the heart valves. The weakened heart must work harder to keep up with the demands of the body, which is why people with heart failure often complain of feeling tired.

Heart failure is often not recognized until a more advanced stage of heart failure, commonly referred to as congestive heart failure, in which fluid may leak into the lungs, feet, legs, and in some cases the liver or abdominal cavity.

Heart failure can cause a number of symptoms including shortness of breath, leg swelling, and exercise intolerance. The condition is diagnosed with echocardiography and blood tests. Treatment commonly consists of lifestyle measures (such as smoking cessation, light exercise including breathing protocols, decreased salt intake and other dietary changes) and medications, and sometimes devices or even surgery.

CLASSIFICATION⁽¹⁾

There are many different ways to categorize heart failure, including:

- The side of the heart involved, (left heart failure versus right heart failure) Left heart failure compromises aortic flow to the body and brain. Right heart failure compromises pulmonary flow to the

lungs. Mixed presentations are common, especially when the cardiac septum is involved.

- Whether the abnormality is due to insufficient contraction and/or relaxation of the heart (systolic dysfunction vs. diastolic dysfunction)
- Whether the problem is primarily increased venous back pressure (behind) the heart Preload, or failure to supply adequate arterial perfusion (in front of) the heart After load (backward vs. forward failure)
- Whether the abnormality is due to low cardiac output with high systemic vascular resistance or high cardiac output with low vascular resistance (low-output heart failure vs. high-output heart failure)
- The degree of functional impairment conferred by the abnormality (as in the NYHA functional classification)
- The degree of coexisting illness: i.e. heart failure/systemic hypertension, heart failure/pulmonary hypertension, heart failure/diabetes, heart failure/renal failure, etc.

Functional classification generally relies on the New York Heart Association Functional Classification.^[2] The classes (I-IV) are:

- Class I: no limitation is experienced in any activities; there are no symptoms from ordinary activities.
- Class II: slight, mild limitation of activity; the patient is comfortable at rest or with mild exertion.
- Class III: marked limitation of any activity; the patient is comfortable only at rest.
- Class IV: any physical activity brings on discomfort and symptoms occur at rest.

This score documents severity of symptoms, and can be used to assess response to treatment. While its use is widespread, the NYHA score is not very reproducible and doesn't reliably predict the walking distance or exercise tolerance on formal testing.^[3]

In its 2001 guidelines the American College of Cardiology/American Heart Association working group introduced four stages of heart failure:^[4]

- Stage A: Patients at high risk for developing HF in the future but no functional or structural heart disorder;

- Stage B: a structural heart disorder but no symptoms at any stage;
- Stage C: previous or current symptoms of heart failure in the context of an underlying structural heart problem, but managed with medical treatment;
- Stage D: advanced disease requiring hospital-based support, a heart transplant or palliative care.

Signs and symptoms⁽⁵⁾:

Heart failure may involve the left side, the right side or both sides of the heart. Each side has two chambers — an atrium (upper chamber) and a ventricle (lower chamber). Heart failure occurs when any one of these four chambers is no longer able to keep up with the volume of blood flowing through it.

Two types of heart dysfunction can lead to heart failure, including:

- **Systolic Heart Failure** — This is the most common cause of heart failure and occurs when the heart is weak and enlarged. The muscle of the left ventricle loses some of its ability to contract or shorten. In turn, it may not have the muscle power to pump the amount of oxygenated and nutrient-filled blood the body needs.
- **Diastolic Failure** — The muscle becomes stiff and loses some of its

ability to relax. As a result, the affected chamber has trouble filling with blood during the rest period that occurs between each heartbeat. Often the walls of the heart thicken, and the size of the left chamber may be normal or reduced.

The left side of the heart is crucial for normal heart function and is usually where heart failure begins. The left atrium receives oxygen-rich blood from the lungs and pumps it into the left ventricle, the heart's largest and strongest pump, which is responsible for supplying blood to the body. After it has circulated through the body, blood returns to the right atrium and then travels to the right ventricle, which pumps it into the lungs to be replenished with oxygen. When the right side loses pumping power, blood can back up in the veins attempting to return blood to the heart. Right heart failure may occur alone but is usually a result of left-sided failure. When the left ventricle fails, fluid backs up in the lungs. In turn, pressure from excess fluid can damage the heart's right side as it works to pump blood into the lungs. Heart failure usually is a chronic, or long-term, condition that gradually gets worse. By the time most people notice and see a doctor about their symptoms, the heart has been "failing," little by little, for a long time.

Symptoms

People, who experience any of the symptoms associated with heart failure, even if they are mild, should consult a doctor as soon as possible. Once a person is diagnosed, it's important to keep track of symptoms and report any sudden changes.

TYPICAL SIGNS OF HEART FAILURE INCLUDE:

- **Breathlessness or Shortness of Breath (Dyspnea)** — When the heart begins to fail, blood backs up in the veins attempting to carry oxygenated blood from the lungs to the heart. As fluid pools in the lungs, it interferes with normal breathing. In turn, you may experience breathlessness during exercise or other activities. As the condition worsens, shortness of breath may occur when at rest or asleep. These periods of breathlessness may leave you feeling exhausted and anxious.
- **Fatigue** — As heart failure becomes more severe, the heart is unable to pump the amount of blood required to meet all of the body's needs. To compensate, blood is diverted away from less-crucial areas, including the arms and legs, to supply the heart and brain. As a result, people with heart failure often feel weak (especially in their arms and legs), tired and have difficulty performing ordinary activities such as walking, climbing stairs or carrying groceries.
- **Chronic Cough or Wheezing** — The fluid buildup in the lungs may result in a persistent cough or wheezing, that may produce phlegm (a thick, mucous-like substance) that may be tinged with blood.
- **Rapid or Irregular Heartbeat** — The heart may speed up to compensate for its failing ability to adequately pump blood throughout the body. Patients may feel a fluttering in the heart (palpitations) or a heartbeat that seems irregular or out of rhythm. This often is described as a pounding or racing sensation in the chest.
- **Lack of Appetite or Nausea** — When the liver and digestive system become congested they fail to receive a normal supply of blood. This can make you feel nauseous or full, even if you haven't eaten.
- **Mental Confusion or Impaired Thinking** — Abnormal levels of certain substances, such as sodium, in the blood and reduced blood flow to the brain can cause memory

loss or disorientation, which you may or may not be aware of.

- **Fluid Buildup and Swelling** — Because blood flow to the kidneys is restricted, the kidneys produce hormones that lead to salt and water retention. This causes swelling, also called edema that occurs most often in the feet, ankles and legs.
- **Rapid Weight Gain** — The fluid build-up throughout the body, may cause you to gain weight quickly.

These symptoms occur as the heart loses strength and the ability to pump blood throughout the body. In turn, blood can back up and cause "congestion" in other body tissues, which is why heart failure sometimes is called "congestive." In addition, excess fluid may pool in the failing portion of the heart and the lungs.

At the same time, the heart as well as other parts of the body attempt to adapt and make up for the deteriorating pumping ability. For example:

- **Heart Grows Larger** — The muscle mass of the heart grows in an attempt to increase its pumping power, which works for a while. The heart chambers also enlarge and stretch so they can hold a larger volume of blood. As the

heart expands, the cells controlling its contractions also grow.

- **Heart Pumps Faster** — In an attempt to circulate more blood throughout the body, the heart speeds up.
- **Blood Vessels Narrow** — As less blood flows through the arteries and veins, blood pressure can drop to dangerously low levels. To compensate, the blood vessels become narrower, which keeps blood pressure higher, even as the heart loses power.
- **Blood Flow Is Diverted** — When the blood supply is no longer able to meet all of the body's needs, it is diverted away from less-crucial areas, such as the arms and legs, and given to the organs that are most important for survival, including the heart and brain. In turn, physical activity becomes more difficult as heart failure progresses.

Although the body's ability to compensate for the failing heart initially is beneficial, in the long run these adaptations contribute to the most serious cases of heart failure. For example:

- An enlarged heart eventually doesn't function as well as a normal

heart, and the extra muscle mass adds stress to the entire cardiovascular system.

- The organ systems from which blood has been diverted may eventually deteriorate because of an inadequate supply of oxygen.
- Narrowing of the blood vessels limits the blood supply and can contribute to conditions such as stroke, heart disease and clogged or blocked blood vessels in the legs and other parts of the body.
- Pumping blood too fast for too long can damage the heart muscle and interfere with its normal electrical signals, which can result in a dangerous heart rhythm disorder.

CAUSES OF HEART FAILURE ⁽⁶⁾:

For heart failure to occur there must be an unresolved impairment of the heart that compromises its ability to work as a pump. The source of this can be a cut off of blood supply, an increase in workload due to high blood pressure caused by non-functioning valves or a genetic predisposition. Heart failure can be worsened by a poor diet and lifestyle. Its development follows the scheme below:

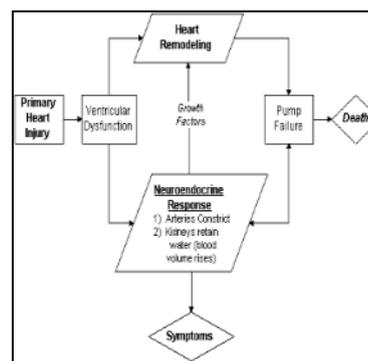


Figure 1: Conditions That May Lead To Heart Failure

Coronary Artery Disease (CAD)

This is the most common cause of heart failure causing obstruction to the coronary arteries prevents blood flow and, therefore, oxygen delivery to the heart. CAD is a manifestation of atherosclerosis, which can affect any artery of the body. Risk factors for CAD also include smoking, high cholesterol, hypertension, and diabetes.

Hypertension

This is more commonly known as high blood pressure. It is a condition that is treatable and simple to diagnose with a blood pressure cuff. Although most individuals will not have symptoms, hypertension is detected by a simple measurement with a blood pressure cuff and stethoscope. It is also a risk factor for CAD, stroke, peripheral vascular disease, or kidney impairment.

Valvular Heart Disease

A condition that occurs when the valves

between the chambers of the heart are faulty, either due to birth defect or injury.

Cardiomyopathy

A disease of the heart muscle. This can be one of many varieties. It can arise because of genetic causes, a viral infection, or consumption of toxins (lead, alcohol, etc.). In peripartum cardiomyopathy, women who have recently given birth can develop heart muscle impairment. In many cases, the condition is called "idiopathic", which means it has occurred of uncertain origin or cause.

In addition to those causes above, the following factors also can play a role in determining if heart failure will affect you:

1. Family history of heart failure
2. Diabetes
3. Marked obesity
4. Heavy consumption of alcohol, or drug abuse
5. Failure to take medications
6. Large salt intake in diet
7. Sustained rapid heart rhythms

Many other conditions can actually simulate heart failure symptoms - it is important to seek evaluation from a medical professional for a definitive diagnosis. Some of these are:

1. Lung impairment
2. Anemia

3. Kidney impairment
4. Pericardial disease (rare)

Pathophysiology of Heart Failure

Normal myocardial function requires sufficient nutrient-rich, toxin-free blood at rest and during exercise; sequential depolarization of the myocardium; normal myocardial contractility during systole and relaxation during diastole; normal intracardiac volume before contraction (preload); and limited resistance to the flow of blood out of the heart (afterload). The capacity of the heart to adapt to short-term changes in preload or afterload is remarkable, but sudden or sustained changes in preload (e.g., acute mitral regurgitation, excessive intravenous hydration), afterload (e.g., aortic stenosis, severe uncontrolled hypertension), or demand (e.g., increased demand because of severe anemia or hyperthyroidism) may lead to progressive failure of myocardial function. Asymptomatic dysfunction progresses steadily to overt heart failure.

Coronary artery disease accounts for nearly 70 percent of all cases of heart failure. Less frequent causes include diabetes mellitus and valvular heart disease. Heart failure also can be multifactorial. For example, the disease can result from acute myocardial infarction

(loss of myocardial contractility) with preload) and acute pulmonary edema papillary muscle dysfunction (increased (hypoxemia).

RESULTS AND DISUSSION:

Evaluation for Heart Failure⁽⁷⁾

Heart failure is diagnosed based upon medical history, an exam, and a series of tests.

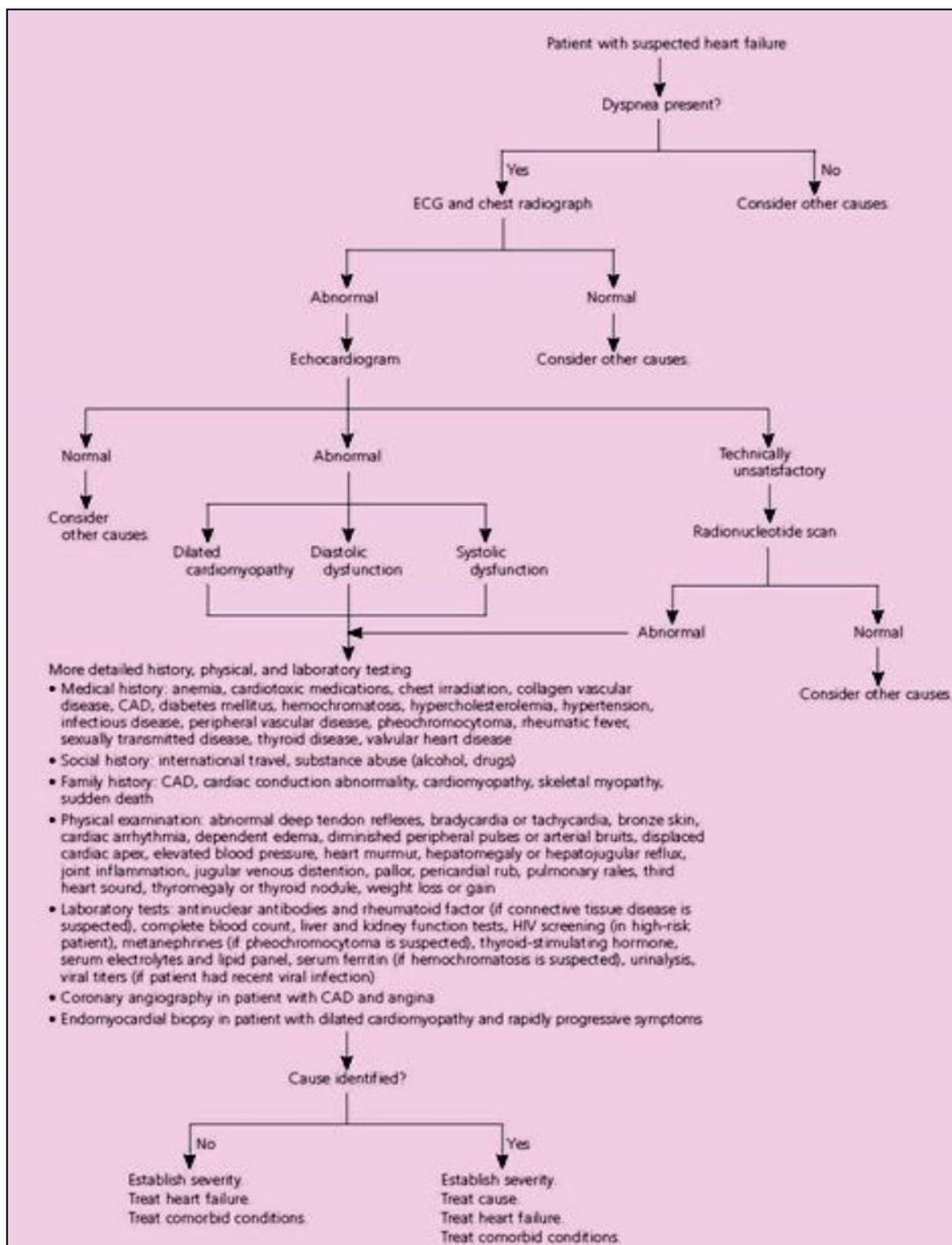


Figure 2: Evaluation of Heart Failure

These tests can tell how well heart is working and can help determine the cause of heart failure. Tests may include:

- Chest X-ray — A chest X-ray shows the size and shape of the heart and the large blood vessels in the chest. It also can show if there is fluid in the lungs.
- Electrocardiogram (EKG) — An EKG provides a picture of the electrical activity that causes the heart to beat. An EKG may detect conditions, such as an abnormal heart rhythm or a previous heart attack that could cause heart failure.
- Echocardiogram — An echocardiogram uses ultrasound (high-frequency sound waves) to assess the size and function of the heart's chambers and the structure and function of the heart valves. A follow-up echocardiogram can be done to see if your heart function changes over time.
- Exercise testing — An exercise test ("stress test") determines how well your heart performs during exercise. It is one way to look for signs of a shortage of blood supply to your heart caused by blockages

in the coronary arteries. A doctor or nurse will see how your heart responds to exercise by looking at the EKG, blood pressure, and heart rate as you walk on a treadmill. In addition, pictures may be taken to measure the effect of exercise on the heart.

- Heart (cardiac) catheterization — Cardiac catheterization helps to measure how well the heart is functioning and provides pictures of the coronary arteries to look for blockages. During the test, a thin tube (the catheter) is inserted through a large blood vessel in the groin (or arm) and advanced into the heart. A dye is injected into the catheter to view the arteries and the structure of the heart by X-ray.
- Other tests — Cardiac catheterization is an invasive test that can have risks. Other tests, like CT or MRI, are sometimes used to look at the coronary arteries. This type of test is recommended only in specific situations

MANAGEMENT OF HEART FAILURE⁽⁸⁾:

- Although heart failure is a serious condition that progressively gets worse over time, certain cases can

be reversed with treatment. Even when the heart muscle is impaired, there are a number of treatments that can relieve symptoms and stop or slow the gradual worsening of the condition.

- The goals of heart therapy are to:
- Relieve symptoms and improve quality of life
- Slow disease progression
- Reduce the need for emergency room visits and hospitalization
- Help people live longer
- Treatment options depend on the type, cause, symptoms and severity of the heart failure. Usually, more than one therapy is used. These options include:
- Treating the Underlying Causes
- Lifestyle Changes
- Medications
- Surgery

Treating the Underlying Causes

- A number of conditions can contribute to heart failure. Treatment of these other factors may range from surgery or angioplasty to open clogged blood vessels in patients with coronary artery disease to medications prescribed to control high blood pressure, diabetes, anemia or

thyroid disease. In addition, it's particularly important to treat abnormal heart rhythms called arrhythmias in patients with heart failure.

Lifestyle Changes

- These modifications often improve or control some of the factors contributing to heart failure. For example, people with heart failure will see an improvement if they:
- Modify daily activities and get enough rest to avoid stressing the heart
- Eat a heart-healthy diet that is low in sodium and fat
- Don't smoke and avoid exposure to second-hand smoke
- Don't drink alcohol or limit intake to no more than one drink two or three times a week
- Lose weight
- Avoid or limit caffeine intake
- Get regular exercise, which may include a physical rehabilitation program, once symptoms are stable
- Reduce stress
- Weigh yourself daily, for a sudden increase may signal fluid build-up
- Keep track of symptoms and report any changes
- Have regular checkups to monitor the condition

Medications

- A number of medications are prescribed for heart failure, and most patients will take more than one drug. Medications may be prescribed to:
 - Dilate blood vessels
 - Strengthen the heart's pumping action
 - Reduce water and sodium in the body to lessen the heart's workload

TYPES OF MEDICATION INCLUDE:

- Angiotensive converting enzyme (ACE) inhibitors, which dilate, or widen, the arteries, improving blood flow and making it so that the heart doesn't have to pump as hard. ACE-Inhibitors counteract the action of certain compounds formed by the body to regulate heart failure but which can contribute to disease progression.
- Beta-blockers lower blood pressure and decrease and block the effect of harmful hormones that can cause disease progression.
- Diuretics or water pills help the kidneys produce more urine and rid the body of excess fluid, which can stress the heart.
- Spironolactone is a form of diuretic that preserves potassium and has been shown to reduce

hospitalization and prolong life when used to treat advanced heart failure.

- Potassium and magnesium supplements are often prescribed with diuretics to replace these minerals, which are excreted in urine.
- Digoxin makes the heart beat stronger and slower, and regulates the rhythm of its contractions.
- Anti-arrhythmic drugs treat abnormal heart rhythms.
- **Surgery**
- Surgical options to treat underlying causes of heart failure include:
 - Coronary artery bypass graft (CABG or "cabbage") or angioplasty to prevent and treat heart failure caused by blocked arteries. During bypass surgery, blood vessels taken from another part of the body — usually the legs — are used to link the open parts of a blocked artery around the blockage. In angioplasty, a thin flexible tube called a catheter is inserted through a small incision in the groin or neck into a blood vessel. In one procedure, a balloon is introduced through the catheter into the center of a blocked blood vessel. When the balloon is

inflated, the blockage material is compressed back against the walls of the artery. A small metal device, called a stent, may be inserted through the catheter to serve as a permanent barrier to keep the plaque compressed. In another type of procedure, instruments are introduced through the catheter to remove the plaque.

- Implantation of pacemakers and other devices such as artificial heart valves
- Repairing congenital heart defects
- Surgical treatments for heart failure itself include:
- **Heart Transplantation** — Although a heart transplant may be the best option for patients with the most severe types of heart failure, this treatment is available to only a small number of people due to a shortage of donor hearts. Recent advances may make artificial heart transplantation an option in the future.
- **Left Ventricular Assist Devices (LVAD)** — These may be implanted in the chest to increase heart pumping action. Until recently, LVADs required that the patient be hooked up to a large, hospital-based console while

awaiting a transplant. Miniaturized battery-powered LVAD units, however, are allowing many patients to leave the hospital. The devices may be used as a primary treatment or as a bridge to heart transplant in adults.

- **Heart Reconstruction** — The electrical signals that cause the heart to contract move in a spiral pattern. Ideally the heart is an elliptical shape, like a football, for this makes it easier to receive the electrical signals that trigger heartbeats. In heart failure, the heart often enlarges and become spherical, more like a basketball, which no longer "fits" the electrical pattern and makes the heart less efficient. A number of promising surgical procedures are being investigated to address this problem by reconstructing parts of the heart to normalize its shape. These heart reconstruction procedures include:
 - Valve repair and revascularization, which may reduce heart size and improve cardiac function.
 - Dynamic cardiomyoplasty, in which one end of a muscle from the patient's back is detached and wrapped around the ventricles of the heart. After a few weeks, the relocated muscles are conditioned

with electrical stimulation to behave and beat as if they were heart muscles. The procedure may improve pumping ability, thereby limiting heart enlargement and reducing stress.

- The Batista procedure, also called "partial left ventriculectomy," removes a section of the wall of the left ventricle. The edges of the ventricle are repositioned and sewed together and the mitral valve and valve parts are repaired or replaced. This procedure has been largely abandoned due to poor results.
- The Dor procedures, also called "endoventricular circular patch plasty" or EVCPP, are used when a widening (aneurysm) forms in the ventricle following a heart attack. In the surgery, a looped stitch is created to shrink the area of dead, scarred tissue where the aneurysm formed. Sometimes, a patch made of Dacron or tissue is used to cover other areas of defective muscle. The goal of the surgery is to return the ventricle to a more normal size and shape.
- The Acorn procedure involves slipping a mesh-like "sock" around the heart and stitching it in place to reduce or prevent any further heart enlargement.

CONCLUSION:

Heart failure occurs when the heart cannot pump enough blood and oxygen to support other organs. Heart failure is a serious condition, but it does not mean that the heart has stopped beating. Early diagnosis and treatment can improve quality of life and life expectancy for people who have heart failure. Treatment usually involves taking medicines, reducing salt in the diet, and getting daily physical activity. In view of the known benefits of exercise, in the context of a global cardiac rehabilitation program including risk factor modification, many patients with cardiac disease could benefit from regular physical activity. Such a program should clearly define the type, intensity, frequency and duration of exercise. Careful screening of patients, appropriate medical supervision, when indicated, and adherence to the exercise prescription help to provide maximal benefits at the lowest risk. Eventually, the heart and body are unable to keep up with the added stress. If patients wait until they experience obvious symptoms of heart failure before seeing a doctor, the condition already may be life-threatening.

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