

Emergent Management of Heart Failure

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Received: December 26, 2021; **Published:** December 30, 2021

Abstract

Introduction: An increased rate of mortality and morbidity is seen in patients with acute heart failure. Doctors working in the emergency department (ED) very frequently deal with patients with acute heart failure, and the number goes up to 6 lacs in the emergency departments in the United States. The sedentary lifestyle and increased intake of high-calorie food in the form of junk food predispose many people to a risk of heart failure. Acute heart failure has many causative factors, with the end result being reduced perfusion and increased cardiac pressure. The most important aim of treatment is the correction of hemodynamics and treatment of the underlying disease leading to the failure.

Aim of Study: This review aims at overviewing the emergent management of Heart Failure.

Methodology: This review is a comprehensive research of PUBMED and Google Scholar from the year 2004 to 2018.

Conclusion: A huge number of emergency department admissions account for acute heart failure patients. Emergent management of patients in the ED helps to decrease the overall mortality rate associated with heart failure. Once the patient is admitted to the ED with heart failure, it's better to categorize it according to the present blood pressure and systemic overload. Nitroglycerin is the preferred choice for hypertensive patients, and cases with increased systemic overload require diuretics. Mechanical circulatory devices can be used for better circulation in patients with Cardiogenic shock. Underlying etiology should be kept in mind, and all efforts should be put to elite the underlying etiology. Once the emergent treatment is done, patients should be divided into high-risk, and low-risk factors category and disposition should be done accordingly.

Keywords: Acute Heart Failure; Mechanical Circulating Devices; Atrial Fibrillation; Systemic Overload; Diuretics; Vasoconstrictors

Introduction

An increased rate of mortality and morbidity is seen in patients with acute heart failure. Doctors working in the emergency department very frequently deal with patients with acute heart failure, and the number goes up to 6 lacs in the emergency departments in the United States. The sedentary lifestyle and increased intake of high-calorie food in the form of junk food are predisposing a huge number of people to a risk of heart failure. A cardiac abnormality, be it structural or functional, generally gives rise to Heart failure. This abnormality causes an impaired filling of the ventricles and a reduced ejection volume which decreases the cardiac output, and as a result, the intracardiac pressure is increased [1].

Heart failure is more commonly seen in men (33%) as compared to women (28%). There is an increased risk in patients above the age of 70 (10%) every year [2]. The mortality rate following acute heart failure goes to about 10% during admission, followed by 6.5% 30 days post-discharge and 30% one-year post-discharge [3].

Acute heart failure refers to an aggravation of existing signs and symptoms of heart failure or a sudden onset of new symptoms. The most common etiological factor is cardiac ischemia, where there is partial or total occlusion of the coronary arteries. Such cases have increased pressure inside the heart and a decreased cardiac output which causes edema. This leads to a decrease in the contraction of the myocardium, and hence the management includes restoring the perfusion in order to balance the myocardium contractility. Other reasons, including inflammatory conditions like cardiomyopathy, drug-induced toxicity, a hypermetabolic state during thyroid storm, or sudden unknown causing factors like peripartum cardiomyopathy, are also responsible for acute heart failure. For such cases, the line of treatment should have a multifaceted approach and should also focus on treating the underlying disease-valvular insufficiency, most commonly the subvalvular apparatus which causes mitral regurgitation. Mitral regurgitation can also result due to infective and non-bacterial endocarditis [3].

Acute heart failure has many causative factors, with the end result being reduced perfusion and increased cardiac pressure. The most important aim of treatment is the correction of hemodynamics and treatment of the underlying disease leading to the failure [3].

Management of heart failure

The main aim of treatment in heart failure cases is to stabilize hemodynamic imbalance and relief from the symptoms with which the patient presented to the emergency department. The first line of treatment as per the acute decompensated heart failure national registry trial is the administration of vasoactive medications—the key to a better prognosis in the early diagnosis and commencement of treatment for heart failure cases. The ADHERE trial concluded that a delay of every 6 hours in the treatment decreases the chances of survival by 6.8%. The earlier the treatment is started, the shorter the duration of stay in the hospital. As soon as the patient is admitted to the emergency, he/she should be checked for airway breathing and circulation [4].

Patients should be checked for any associated or unassociated comorbidities and a history of chronic heart failure. The respiratory status of the patients should not be ignored, and respiratory support, if required, should be instantly provided. Another factor to be kept in mind is the blood pressure of the patient. The baseline blood pressure of the patients should be noted, and treatment should be planned accordingly. Such patients may not show signs of pulmonary edema at very high blood pressure readings or may sometimes show signs of poor perfusion at a low or normal blood pressure reading. This review classifies blood pressure into different categories (Table 1) with their associated management techniques. An important aspect to keep in mind while creating an emergency heart failure is the base blood pressure of the patient and the signs and symptoms that the patient presents with [5].

Type of heart Failure	Systolic Blood Pressure
1. Mild aggravation of acute heart failure	100 - 140 mm Hg
2. Hypertensive Heart Failure	More than 140 mm Hg
3. Hypotensive Heart Failure	Less than 90 mm Hg
4. High output Heart Failure	Hyper dynamic heart - low systemic resistance

Table 1: Categories of heart failure and associated systolic BP [5].

Mild aggravation of acute heart failure with systemic overload

This category includes almost 35% of all heart failure patients. The systolic blood pressure reading is around 100 - 140 mm Hg. These patients have a history of coronary artery diseases leading to a reduced ejection fraction [6]. Symptoms like an increase in body weight and peripheral edema are seen, which increase gradually. The first line of treatment for such cases is diuresis, with the aim of balancing the body volume. If the patient is already consuming furosemide, the oral dose is determined and a 1 - 2 times higher dose is administered intravenously. Patients who do not show any improvement with furosemide can be given bumetanide at 1 mg or furosemide at 20 - 40 mg [7]. The speed of infusion and the dosage administered are determining factors in the overall outcome of the treatment. Infusion done at a continuous pace is seen to be associated with increased urine output. If the patients present with pulmonary edema, sublingual nitroglycerin should be given immediately. Patients who are resistant to the diuretic treatment or have elevated creatinine and troponin reading are classified as high-risk category and should be admitted as in-patient and kept under observation and therapy [8].

Heart failure associated with hypertension and pulmonary edema

This accounts for almost 50% of acute heart failure patients. The left ventricular and end-diastolic pressure increases, giving rise to flash pulmonary edema. As a result, the pulmonary pressure increases, and alveolar fluid is elevated. The patient experiences lack of oxygen and shortness of breath. Symptoms in this category are the most aggravated, but the mortality rate is low as compared to other categories [9]. The first line of treatment is respiratory support in these cases with noninvasive positive pressure ventilation and nitrates. These patients generally have a balanced body volume, but diuretics can be administered in rare instances in which the volume is increased [10]. Noninvasive positive pressure ventilation increases the oxygen level and cardiac functioning, decreasing the mortality rate [11]. Hypertensive patients should be provided with sublingual nitroglycerin straight away in a dose of 400 mg; sublingual nitroglycerin should be administered before the patient is masked or intubated [12].

Cases where the blood pressure is not declining after sublingual nitroglycerin dose, can then be provided with iv nitroglycerin at a dose of 2000 mg every three minutes [13]. Nitroprusside can also be used for vasodilation but has shown various side effects like accumulation of cyanide in medically compromised patients. Nesiritide is another drug that is used to reduce the left ventricular filling pressure and decrease venous resistance. A dosage of 2 mg/kg is initially given, followed by infusion at the rate of 0.03 mg/kg/min [14]. Once the patient's emergency treatment has been done, they can be kept on a prescription of Angiotensin-converting enzyme inhibitors. It can be administered to patients when they are still hypertensive, even after nitroglycerine and NIPPV. ACE inhibitors have shown a decreased rate of mortality in the patients. After administering the first dose of ACE inhibitors, the patient must be checked for any signs of hypotension. If the patients have any fluid imbalance, they should be administered diuretics once the hypertensive state is under control. Diuretics are administered at a dose of 1 - 2 times, patients' existing oral dose [8] (Figure 1).

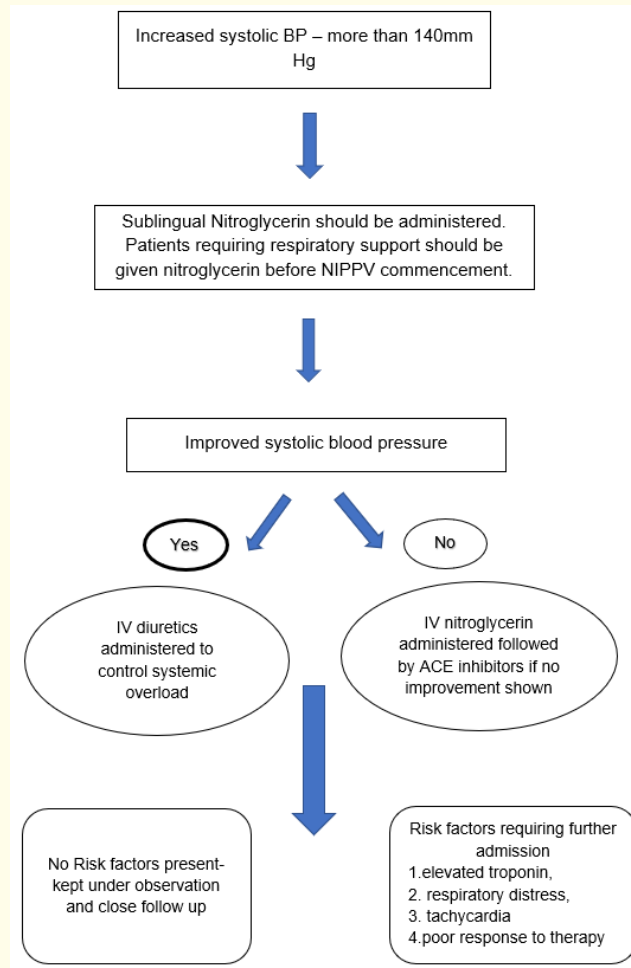


Figure 1: Emergent management of acute heart failure associated with hypertension [5].

Heart failure associated with hypotension and cardiogenic shock

This is the most infrequently reported form of heart failure, accounting for less than 5% of cases, but it is the most difficult category to manage and has the highest mortality rate [15]. In such cases, with low blood pressure, immediate resuscitation is required with the administration of inotropic agents and emergent surgery. Instant revascularization is required in cases associated with myocardial infarction, and those with pathologies associated with the valves require emergent surgery [15]. A low dose of inotrope should be administered for a short time to act as a bridge until surgical or mechanical therapy can be started. Inotrope administration reduces the chances of any end-organ damage and increases cardiac output. Despite the advantages, inotropic agents are used for a small duration because they are associated with certain side effects like dysrhythmias, hence the smaller duration and low dosage. Inotropes have not shown any significant decrease in mortality rate [16]. Epinephrine, Norepinephrine, and Dobutamine can be used to increase blood pressure and cardiac output. Epinephrine and norepinephrine, when used together, help to increase cardiac output [17]. As compared to norepinephrine, epinephrine usage is limited as it's associated with an increased risk of refractory shock. A trial was done in 2010, compared norepinephrine

with dopamine and concluded that norepinephrine had an increased effect on patients with cardiogenic shock and proved to be more effective in treating dysrhythmias and decreasing mortality rate [18].

Patients who are in respiratory distress require immediate support with NIPPV, but NIPPV is associated with a reduction in afterload and preload, making it necessary that the patient has already been started on inotropes and has good vascular access [15].

Patients in whom the cardiogenic shock is not improving or requiring immediate cardiac stabilization are then provided with mechanical circulatory support [15]. Various mechanical circulatory support devices are listed in table 2 and figure 2 [19].

1. Intra-aortic balloon pump	Used for mitral regurgitation and ventricular septal defect
2. Percutaneous MCS	
3. Tandem Heart	Causes flow of oxygenated blood from the left atrium to the lower abdominal aorta.
4. Extracorporeal membrane oxygenation	Used in cases where the oxygenation is poor and not improving with any other device

Table 2: Mechanical circulatory devices [19].

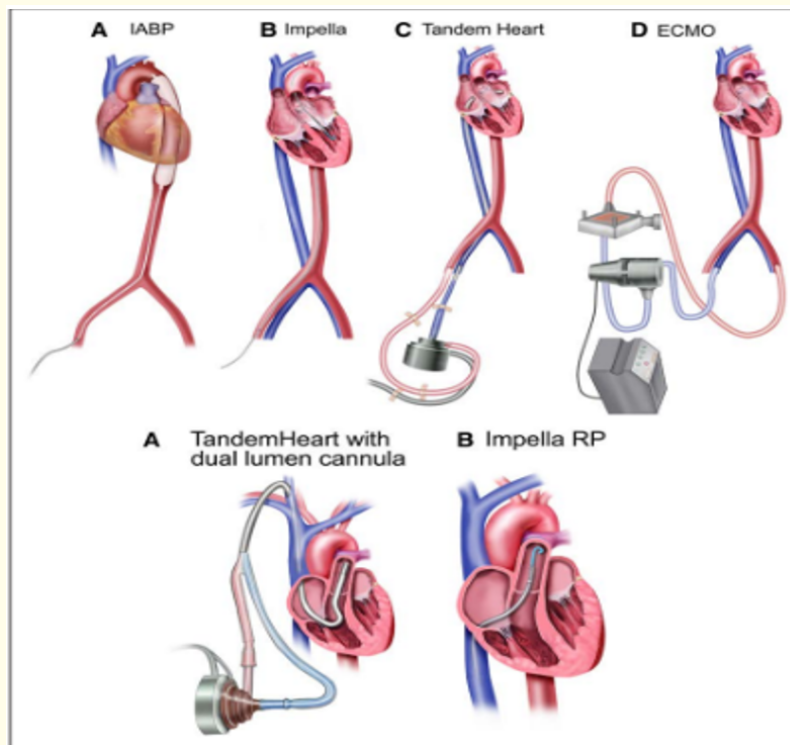


Figure 2: Mechanical circulatory devices and their functioning [19].

High-output heart failure

Patients presenting with high output heart failure have similar symptoms as other categories of heart failure. They have an increased ejection fraction and warmer extremities. The main reasons leading to a high output heart failure are:

1. Large extracardiac left to right shunt which causes reduced renal perfusion
2. Reduced capacity for carrying oxygen
3. Overstimulation of the body mechanism
4. Anemia
5. Thyrotoxicosis
6. Septic shock
7. Multiple myeloma
8. Paget's disease [20].

The management techniques for this category are scarce as they end up having a deleterious effect on the hemodynamic status. The main management technique should focus on correcting the underlying etiology leading to heart failure. Vasoconstrictors can be used as bridge treatment and have a short-term effect on improving the patient's condition [21].

Acute heart failure associated with atrial fibrillation

Cases, where a patient presents with dysrhythmia associated with hemodynamic instability should go for cardioversion [22]. If the patient undergoes immediate cardioversion, some adverse effects can be seen. Digoxin is the preferred choice of drug in atrial fibrillation cases [23].

Conclusion

A huge number of emergency department admission accounts for acute heart failure patients. Emergent management of patients in the ED helps to decrease the overall mortality rate associated with heart failure. Once the patient is admitted to the ED with heart failure, it's better to categorize it according to the present blood pressure and systemic overload. Nitroglycerin is the preferred choice for hypertensive patients, and cases with increased systemic overload require diuretics. Mechanical circulatory devices can be used for better circulation in patients with Cardiogenic shock. Underlying etiology should be kept in mind, and all efforts should be put to elite the underlying etiology. Once the emergent treatment is done, patients should be divided into high-risk and low-risk factors categories, and disposition should be done accordingly.

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Volume 18 Issue 1 January 2022

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