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## Chapter 1

# Understanding Heart Failure

Although heart failure (HF) was observed in ancient times (ancient physicians called it ‘dropsy’), medical science has been slow to respond to its challenge. Unlike other things that concern cardiologists, HF is a syndrome rather than a disease, i.e. it is a constellation of symptoms. There remains no straightforward way to diagnose the disease; classification systems are more subjective than objective and we are only recently beginning really to understand what goes on when the human heart begins to fail.

The name of the syndrome itself is something of a misnomer. The heart does not ‘fail’ in a sudden spasm. The failure is a gradual, stepwise degeneration. Not too many years ago, all we clinicians could do in the face of progressive HF was keep the patient comfortable in the face of the inevitable decline. Even today, the prognosis for HF patients is not good. However, new treatment options are changing how we think about HF and that includes not just trying to stop the progressive deterioration but actually to fight to reverse it. As clinicians, we are not always successful in the fight against HF, but every year we become better and better equipped. In fact, Dr John G. F. Cleland stated recently in an interview that at this point in medical history, ‘I think it’s realistic to talk in terms of remission of heart failure.’<sup>1</sup>

Most clinicians have heard the term congestive heart failure (CHF). Although you still hear it, it is starting to sound old-fashioned. Congestion is a troublesome and extremely obvious symptom of advanced HF. Today we know that patients can have HF without congestion. In fact, by the time fluids start to accumulate, the heart has withstood considerable assault. Early treatment of HF involves diagnosing and managing the syndrome long before fluid overload becomes a problem. In fact, Dr. Jonathan Sackner-Bernstein wrote that not treating a heart failure patient until fluid accumulation oc-

curred was similar to waiting for metastasis rather than screening for a primary tumor.<sup>2</sup>

The American College of Cardiology and American Heart Association define heart failure as ‘a complex clinical syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill with or eject blood.’<sup>3</sup> There is no objective definition of HF because there are no currently agreed-upon cut-off values in terms of cardiac dysfunction, such as change in flow, pressure, dimension or volume. The main symptoms are shortness of breath and fatigue, which often manifests as exercise intolerance. Fluid retention may be observed and, even if present, may not dominate the clinical presentation. A straightforward diagnosis is not possible and, when diagnosed, HF should not be the sole finding.

HF impairs the heart’s ability to pump blood and that, in turn, causes an inadequate blood supply to the body’s main organs. This lack of oxygen-rich blood flow to the brain, liver and kidneys is responsible for some of the symptoms of HF. As the heart’s pump becomes less effective, blood can pool in the heart and stagnate. It can back up into the veins or clots may form, increasing the patient’s risk of stroke. The symptoms relate to an inadequate oxygenated blood supply to the body, including:

- Dyspnea (shortness of breath)
- Fatigue, feeling overtired
- Edema or fluid accumulation.

### Types of heart failure

Since the definition of HF is vast, it is not unusual for clinicians to describe HF further to help describe the type and stage of the condition. Some of the adjectives used with HF include: chronic, acute, congestive, decompensated, systolic, diastolic, right-sided and left-sided.

Acute heart failure (AHF) is used to describe two different things. Sometimes the term is heard for new-onset cases of HF. However, the term is often applied when a patient with heart failure experiences a sudden and dangerous worsening of symptoms, typically characterized by pulmonary or peripheral congestion (or both). Patients with chronic heart failure may have bouts of AHF, sometimes requiring emergency hospitalization.

Decompensation is a term that means ‘failure to compensate’. It describes quite well what happens as heart failure progresses. In the early stages of HF, the heart develops some radical methods to compensate for its failings and still provide the body with an adequate supply of oxygenated blood. As the heart continues to fail, the heart loses its ability to compensate and starts to pump inadequately. Decompensated HF is an advanced form of HF.

Chronic HF (which confusingly sometimes uses the same acronym as congestive heart failure or CHF) describes most of what we clinicians know as HF. Not long ago, it was common to talk about patients being ‘in heart failure’ or ‘out of heart failure’ as if HF was something that might clear up. While symptoms can be alleviated, today we recognize that HF is a chronic condition.

Systolic and diastolic HF will be discussed in more detail in a later chapter, but they refer to the portion of the cardiac cycle where the heart can no longer pump effectively. Systolic HF may be thought of as the inability to eject blood effectively during the cardiac cycle (aligning with systole), while diastolic HF generally refers to the heart’s inability to fill effectively with blood prior to pumping (matching diastole). While these terms and conditions are important to know, systolic and diastolic HF are not mutually exclusive. Many patients have both together and, over the long term, it is difficult to imagine a patient with systolic HF who does not have impaired diastolic function and vice versa. Thus, when the adjectives ‘systolic’ or ‘diastolic’ appear together with HF, they tend to describe what is more dominant and observable in the patient at that particular point in time.

Left-sided and right-sided HF are sometimes used, but these terms do not indicate which ventricle is the more damaged. Left-sided HF does indeed refer to the left ventricle’s ineffective pumping action of blood and manifests as congestion in the pulmonary veins. Right-sided HF involves im-

paired right-ventricular pumping action, causing congestion in systemic circulation. Left-sided HF is by far the more common type, although cases of ‘true right-sided HF’ have been documented. Over the long term, patients may develop both forms of HF, in that left-ventricular dysfunction eventually causes right-sided failure.

## Classification of HF

When classifying heart failure, the most commonly used method is not necessarily the most elegant. The New York Heart Association (NYHA) came up with a four-level classification scale which is still in broad use around the world today.<sup>4</sup> Although subjective and based on symptoms, the NYHA scale has proven to be exceedingly useful in helping to quantify a syndrome that seems to defy hard definitions. The NYHA scale maps the degree of exertion required to elicit symptoms (see Table 1.1).

The American College of Cardiology (ACC) and American Heart Association (AHA) proposed an alternative classification system for HF which is not in widespread use despite its obvious clinical value. This system allows for the classification of the asymptomatic and mildly symptomatic patient as well as those with more advanced cases of HF without relying on exertion to provoke symptoms. One reason for this new classification system is that we truly do not understand why exercise should provoke symptoms. For instance, it has been observed that some patients with markedly impaired left-ventricular function may be asymptomatic during exercise. Other patients may have symptoms with exercise because of mitral valve regurgitation, pulmonary disease or general poor condition. Thus, the presence of dyspnea with exercise is not necessarily a reliable yardstick.

The ACC and AHA have proposed another classification system<sup>3</sup> (see Table 1.2) which offers the

**Table 1.1** New York Heart Association classification system

<i>NYHA class</i>	<i>Effort required to elicit symptoms</i>
I	Exertion that would limit normal individuals
II	Ordinary exertion
III	Less than ordinary exertion
IV	Rest

**Table 1.2** American College of Cardiology (ACC)/American Heart Association (AHA) classification

ACC/AHA class	Definition
A	Patients at high risk of developing left-ventricular (LV) dysfunction
B	Patients with LV dysfunction who have not developed symptoms
C	Patients with LV dysfunction with current or prior symptoms
D	Patients with refractory end-stage HF

advantage of including asymptomatic (actually, it would be more accurate to say pre-symptomatic) patients without neglecting the progressive nature of the condition.

While the presence of left-ventricular (LV) dysfunction is common in HF patients and is the basis of the ACC/AHA classification scale, the presence of LV dysfunction does not define HF, nor does its absence preclude it.

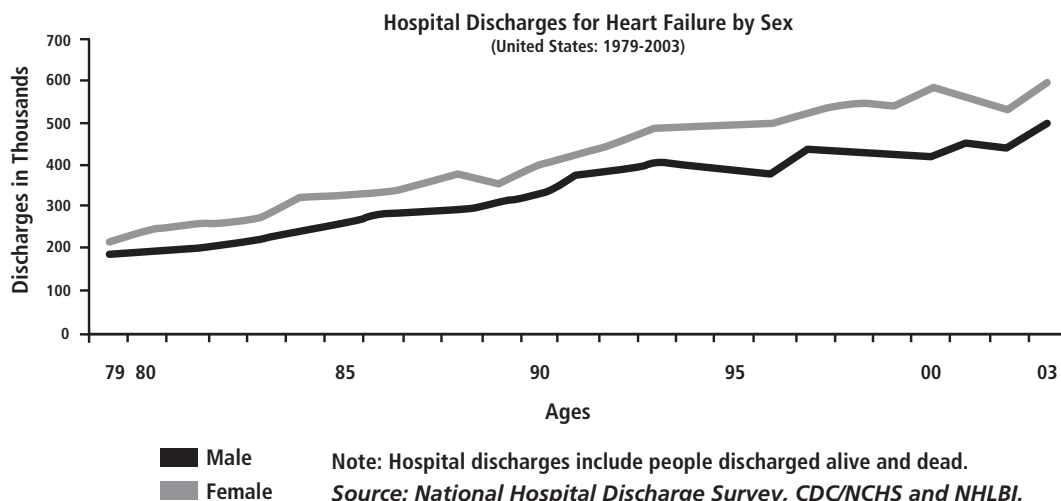
**Incidence, prevalence, populations**

Incidence is a public health term used to define the number of new cases of a disease each year in a particular population. The incidence of HF has been growing steadily from 250 000 annually in

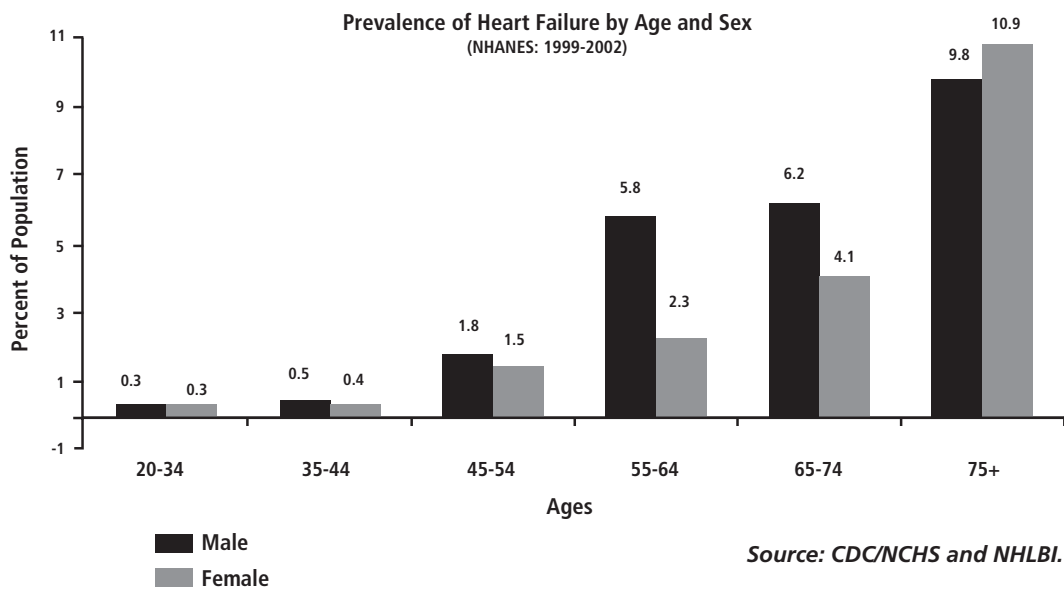
1970 to 400 000 annually in 1990.<sup>5</sup> The AHA says the number in the year 2000 is 550 000 new cases a year.<sup>6</sup> HF is one of the few forms of heart disease actually increasing in incidence. In the population of Americans <75 years old, men are more likely to develop HF than women. At age ≥75 years, the incidence becomes more balanced between the genders. Hospital discharges (patients alive or dead at time of discharge) show that heart failure is increasing over time, more than doubling from 1980 to 2003 (see Fig. 1.1).

Prevalence is another public health term used to describe the number of people who have a condition at any given time. HF is increasing in prevalence mainly because the population, overall, is aging and HF is a chronic condition. Of people above the age of 65, about 6–10% have some form of HF<sup>7</sup> (see Fig. 1.2). As better medical treatment allows people to live longer and as we know how to manage HF better, the prevalence of the syndrome will continue to increase. While the incidence of HF is higher among men (at least up until age 75), the prevalence statistics show that in the USA, more females have HF than males. That is partly due to the fact that women live longer and that many women have a less severe form of HF known as diastolic dysfunction.

HF contributes to more than 287 000 deaths annually. The real extent of the devastation caused by



**Figure 1.1** Hospital discharge rates for heart failure. The number of discharges of people from US hospitals with the diagnosis of heart failure has increased steadily since 1979. The gap between male and female patients has widened over time.



**Figure 1.2** Heart failure prevalence by age and sex. The prevalence of heart failure increases sharply with advancing age. Up to age 74, more men than women have heart failure. This reverses at ages above 75, when slightly more females have heart failure than males. Women tend to develop heart failure later in life and to live longer than men.

HF is probably better captured in what it costs society. HF costs the world about \$60 billion a year and accounts for 12–15 million office visits and 6.5 million hospital days.<sup>8</sup> In the USA, HF is the single most common Medicare diagnosis-related group (DRG) and Medicare spends more on HF than on any other disease.<sup>9</sup>

HF is a progressive disorder that can affect more than just the heart: it often affects the lungs, liver and kidneys. As a patient's functional status deteriorates, his or her chance of survival decreases. In the earlier stages of the disease, HF is associated with a higher incidence of sudden cardiac death, while in later stages, worsening HF is more likely to be the cause of death. The main objective in treating HF patients has been to improve symptoms, reduce the risk of death and disease progression and enhance the patient's quality of life.

One of the latest innovations for HF treatment is cardiac resynchronization therapy, which is a device-based treatment. However, HF requires a multidisciplinary approach and rarely is any HF patient well served by one drug or even one therapeutic approach. It is a complex syndrome which requires careful management.

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### The nuts and bolts of understanding heart failure

- Heart failure (HF) is not a disease with a specific diagnostic test. It is a complex syndrome of symptoms and conditions.
- HF is increasing in incidence and prevalence. In the USA, Medicare spends more on HF than on any other condition. Worldwide, HF costs about \$60 billion annually.
- While there are many ‘types’ of HF, the main one of concern for device-based therapy is chronic HF. It may or may not be accompanied by significant congestion.
- HF affects the heart’s ability to pump blood effectively. It can be systolic (impairs ability to pump blood out) or diastolic (impairs ability of heart to fill with blood). Having one form of HF does not preclude the other. Some patients have both systolic and diastolic HF.
- The most commonly used system to rank HF patients is the New York Heart Association (NYHA) classification, where Class I is the least symptomatic and Class IV is the most symptomatic. These classes are not static and are based on somewhat subjective criteria.
- The American College of Cardiology (ACC)/American Heart Association (AHA) have proposed an alternative classification system of four stages, A–D, where A indicates patients at high risk of developing HF and Class D end-stage refractory HF patients. The ACC/AHA scale is based on degree of left-ventricular dysfunction. Although this is an important classification system, it is not as widely used as the NYHA classes.
- In populations <75 years old, more men than women get HF every year (incidence). At ≥76 years old, the incidence is about equal for men and women. However, more women than men have HF at any given point in time (prevalence), partly because women live longer and partly because they are more likely to have less severe diastolic forms of HF.
- The hallmark symptoms of HF include shortness of breath, fatigue and fluid accumulation. Exercise intolerance is frequently the way patients are classified (the NYHA classification system is based on symptoms that occur based on levels of exertion). While left-ventricular (LV) dysfunction and congestion are common in HF patients, neither one defines HF. In fact, many people with HF may have neither LV dysfunction nor congestion.
- On the other hand, LV dysfunction cannot occur without some degree of HF being present, even if the patient is not (yet) symptomatic.
- The best way to think of HF is as a deterioration of the heart’s ability to pump blood effectively.
- Many other organs can be affected by HF besides the heart, mainly the lungs, liver and kidneys.
- HF is associated with many other conditions (co-morbidities), including diabetes, hypertension and atrial fibrillation.