11. PERMANENT MECHANICAL CIRCULATORY SUPPORT

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Introduction

Mechanical circulatory support devices have typically been used for temporary support and as a bridge to transplantation. The experience gained with the existing devices, specifically the extended durations of successful support, has led to raised expectations for the more chronic and permanent use of mechanical circulatory devices.

While some currently available systems are now being utilized for extended durations outside of the hospital setting, systems are being developed utilizing advanced technologies which will allow for longer term out of hospital, circulatory support.

Heart Failure

Circulatory insufficiency caused by the inability of the heart to pump blood to the organs in sufficient amounts to meet the requirements is defined as congestive heart failure (otherwise referred to as heart failure). This pathophysiological condition is caused by a reduction in myocardial contractility (from a variety of disease processes including both chronic ischemia and the cardiomyopathies) ultimately resulting in death.

Cost of Heart Failure

In terms of human suffering and death, the cost of heart failure is overwhelming. In the United States alone, approximately 1% of the adult population are affected by this condition. The estimated patient population and number of deaths related to congestive heart failure for the U.S.A., Canada and the World are shown in Figure 1. In the U.S.A., heart failure is the primary diagnosis of over 900,000 hospitalizations per year with an annual new diagnosis of over 400,000 individuals. The estimated cost of heart failure in the U.S.A. for 1998 exceeded $20 Billion. Even with the modern advances in therapies, the five year survival rate after diagnosis is very poor. Survival is less than 50% with a median survival after diagnosis of only 1.7 years for males and 3.2 years for females. Heart failure ultimately results in a slow, painful and costly death.

Therapies

For centuries, therapies for this disease have been the subject of in-depth research. To date, there is no single, effective, widely practiced therapy for heart failure patients. While
Figure 1. Estimated patient population and annual deaths due to congestive heart failure.