

# AbioCor Artificial Heart

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**Abstract**—Since the beginning of cardiovascular research and medicine, the idea of one day creating functional artificial heart has been a top goal of biomedical research. In July of 2001, Kentucky doctors implanted the AbioCor artificial heart, the world's first fully functional artificial heart in a patient suffering from heart failure. Designed by Massachusetts Company Abiomed, the replicated heart targets patients with severe heart failure. The device is much less primitive when compared to older attempts, but still supports only large framed, male patients for up to 18 months. However, the product boasts advances in miniaturization, biosensors, plastics and energy transfer, as well as a completely wireless internal battery system.

## I. INTRODUCTION

The Human heart consists of four chambers, the left and right atria and the left and right ventricles. On the right side of the heart the atrium collects blood and which is then pumped into the lungs for oxygenation. Post-oxygenated blood is received by the left atrium and then pumped to the body by the left ventricle. Coronary heart disease (CHD/CAD) is one of the leading causes of heart failure in the United States for men and women (Board). The issue is created from a buildup of plaque in the arteries, or a hardening of the arteries such that there is a blockage of blood flow. Treatment for the disease includes medicines treating blood pressure, diabetes, or high cholesterol levels. In the occurrence of heart failure, other procedures are used to replace specific damaged or clogged arteries. These procedures include coronary artery bypass surgery and minimally invasive heart surgery. However in cases the heart is too damaged, a new heart or an artificial heart is required to replace the old one. It is these

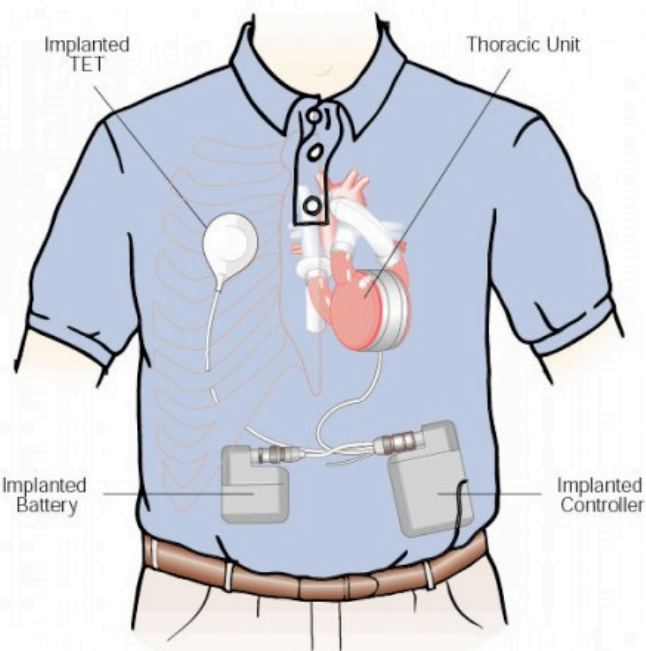


Figure 1: AbioCor Artificial heart (bottom right) extreme cases in which either the heart cannot be repaired or a new heart is unavailable for transplant that an AbioCor would be introduced to a patient.

## II. METHODS

The AbioCor consists of an electronics package planted in the patient's abdomen that monitors and controls the pumping system. The power for the device is supplied externally by a component that utilizes inductive electromagnetic coupling with an internal TET (transcutaneous energy transmission), or a transfer of electricity through the patients skin without penetrating it ("The Artificial Heart"). This reduces the patient's risk of infection. The AbioCor is designed in such a way that the patient can continue to be mobile and live a productive lifestyle due to it's internal motor capable enabling it to pump blood throughout the body at various speeds based on activity, similar to the normal beating heart. The main part of the heart is a thoracic unit, essentially a replication of the heart's main chamber as well as left and right ventricles and atria (AbioCor). See figure one for a more detailed example.

## III. RESULTS

As of September 2004, there were 14 patients already implanted with the AbioCor artificial heart. Studies showed that the device proved to be safe in all cases, and that its greatest benefit occurred in patients with severe heart failure and would otherwise die with alternative treatments. In order to be eligible to receive an AbioCor implant, the recipient must have severe heart failure, and must be presumed to die within two weeks of non-transplantation. The first person ever to receive an AbioCor artificial heart was Robert Tools, who received a heart in 2001 and lived for 151 days after the transplant.

## IV. DISCUSSION

A product of over 30 years of research, the AbioCor implantable replacement heart is the first completely self-contained TAH (total artificial heart). The FDA finally approved it on September 5, 2006 as a Humanitarian Use Device. Even still today, patients who wish to receive an AbioCor implantation must go through a series of qualifications, all recipients are carefully chosen. Additionally, there are only 5 medical centers across the U.S. that have been proved for the use of AbioCor. Despite these limitations, the AbioCor is a landmark of cardiovascular technology and design and has without a doubt saved many lives with its use.

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