

ROLLINGHEART: THE FIRST VALVELESS ARTIFICIAL HEART

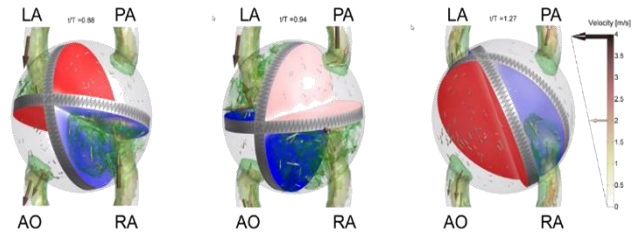
The number of heart transplants worldwide has reached a plateau of 4500/year, but the number of receivers is increasing exponentially, such that the ratio between heart donors and receivers is 1:4 worldwide. There is a clear need for a valid alternative to heart transplant and the total artificial heart seems to be the right one. However, existing devices have proven limited clinical success. Even the latest Carmat device is based on old technology such as bulky hydropneumatic activation with four cardiac valves and is only suitable for a body surface over 1.6 m².

DESCRIPTION

In order to overcome all the technical limitations of existing devices, we propose a valveless positive displacement total artificial heart based on a rotating mechanism directly actuated by an electric motor. The RollingHeart is a double pump consisting of a spherical cavity split into four chambers, like the human heart chambers, by two rotating disks. A movement imposed to one disk entrains the other one, producing a change in the volume of the chambers. This causes the fluid to be ejected into the aorta and pulmonary artery, while the other two chambers decrease in volume, sucking fluid from the vena cava and pulmonary vein. The speed of the motor is controlled by pulse width modulation in closed loop using an optical encoder.

STAGE OF DEVELOPMENT

Extensive bench tests have demonstrated that the device generates a pulsatile flow in two parallel circuits at pressures and flow values in or above the physiological range. We are now ready for preclinical study.



CFD computational study of the RollingHeart. Representation of velocity for 3 normalized time where $T=2\pi/\omega$ is the rotation period of the pump.

ADVANTAGES

The RollingHeart has been conceived for long term biventricular circulatory support for bridge to transplant or as total artificial heart. It has the advantages of both volumetric pumps, such as pulsatility, and centrifugal pumps, such as small dimensions and low noise level. The absence of mechanical/biological valves and the low rotation rate should reduce the risk of thromboembolic events.

INTELLECTUAL PROPERTY

PCT/EP2017/058154 patent application "Artificial heart and its drive unit" extended in national phases in Europe and US

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COLLABORATION TYPE

PACTT offers to grant exclusive or non exclusive license to industrial partners able to develop and commercialize the technology.

PUBLICATION

Tozzi et al, Int J Artif Organs, 2017

REFERENCE

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