

A remote controlled Sensorized Artificial heart enabling patients empowerment and new therapy approaches

SensorART aims at sensorizing Ventricular Assist Devices (VADs), in order to turn VADs from mechanical devices into intelligent systems allowing patients suffering from heart failure to conduct normal lives and help healthcare professionals to monitor patient status remotely and in real-time.

Objectives of the project

Current treatment of heart failure consists of ventricular assist devices (VADs), mechanical pumps implanted in the patient's body used to restore blood circulation. At present, however, VADs are used mainly to bridge heart transplantation.

The SensorART project intends to turn VADs from mechanical devices to intelligent systems, by endowing them with dedicated sensors (i.e. flow, pressure). In this way, VADs could adjust autonomously to the patients' physical needs and monitor his/her status. Most importantly, intelligent VAD systems could be used not only as a bridge to transplant, but also as destination therapy.

Among the expected results of the SensorART project are:

- Monitor and control patient – device interactions
- Therapeutic intervention optimization
- Increase device acceptability
- Patient training and empowerment
- Impact on healthcare delivery
- Reduce hospitalization time
- Increase applicability of VADs as bridge to transplant and as destination therapy
- Modeling and simulation of cardiac and circulatory dynamics of individual patient's status across different conditions
- Specific training of health care providers

The project will also aim at providing scientists with new knowledge of heart recovery.

Project Description

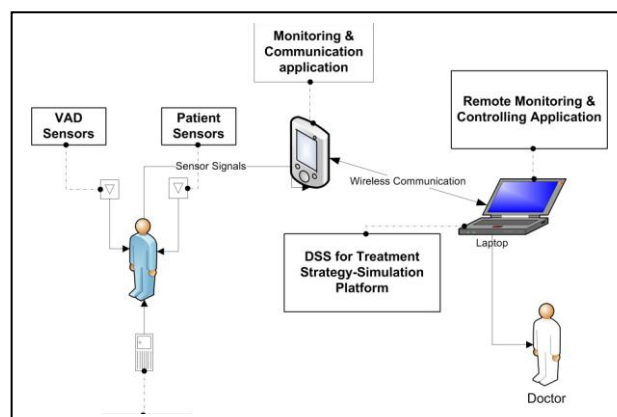
Mechanical artificial hearts are currently used as a bridge to heart transplantation and more recently, as “destination therapy” due to the shortage of heart donors as well as increasing pathology in the aging society. There is experimental evidence that chronic unloading of the heart leads to improved heart function. Clinical experiences report the possibility of improving cardiac function to the extent that the patient could be weaned from the device and transplantation avoided. Heart recovery mechanisms and related time are still unknown since today assistance device devices are mainly implanted in patients with end-stage heart failure.

The clinical significance of such bridge-to-recovery strategy is emerging. It allows the implant of the devices:

- as an alternative to heart transplantation
- in case of life-threatening device-related complications (e.g. recurrent thromboembolism or device infection)
- when urgent transplantation is unfeasible.

Moreover, there is evidence that patients have better quality of life following recovery as compared to heart transplantation and bridge-to-transplantation patients.

Patients assisted by VADs can recover their natural heart function and leave the transplant waiting list, especially if the natural history of the disease is not longer than 5 years.



SCENARIO

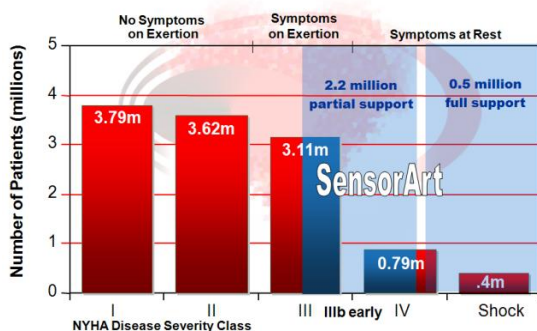
In patients with implanted sensorized artificial heart, the device is linked wirelessly to an external control unit, which is applied to the waist by means of a belt. The artificial heart is powered wirelessly by an innovative system for energy transfer via the skin. Thanks to different assembled sensors, as well as to special algorithms, the control unit can monitor the patient's physiological conditions and optimize support from the pump. In this way, the empowered patient can lead a normal life. Moreover, via wireless Internet communication the control unit allow doctors to monitor the patient's status in real-time and remotely, and to take immediate action when required.

Expected Results & Impacts & Preliminary results

Societal & economic benefits expected

- Shift the application from bridge to transplantation to definitive device also for elderly people
- Abolish power supply cables by Transcutaneous Energy Transfer with improved outcomes and increased patient acceptance
- Extend the use of VADs to less severe state of heart failure with a possibility of application in more than 5 million people
- Understand the natural heart recovery mechanism
- Extend the application of intelligent artificial heart devices for transient therapeutic treatment
- Empower patients by means of user-friendly ICT devices

Increasing number of LVAD implants as destination therapy Older patients



SensorART

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Instrument: IP

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KEYWORDS

Ventricular assist devices, heart recovery, sensors and biosensors, transcutaneous energy transfer.