Examination of pediatric pulmonary circulation assist device based on Fontan circulation animal experimental model

We studied possibility of the high frequency current energy transmission through direct or capacitive coupling. In this study, we examined the hemodynamics changes in the device driving the animal experimental model. The animal experimental model was constructed in four adult goats (45.8±15.6 kg). The right heart bypass from inferior vena cava to pulmonary artery was constructed by using extracardiac conduit, and the left ventricular assist device was connected to reduce of left ventricular load. The device could be mounted easily to the conduit in the thoracic cavity. The pulsatile flow could be generated in the pulmonary circulation by the device contraction. We performed the evaluation of the pediatric pulmonary circulation assist device in the animal experimental model.

Transcutaneous energy transmission system (TETS) was studied in order to realize a complete implanted artificial heart. A electromagnetic induction coupling was used in most TETS. Because the living body can be considered as a conductive and a dielectric material, it is possible to drain a high frequency current through direct or capacitive coupling into the body. In this study, we studied possibility of the high frequency current energy transmission through direct or capacitive coupling. A direct or capacitive coupling TETS was developed using two 2 cm square aluminum foils as electrodes of the TETS. For capacitive coupling TETS the electrodes covered with polymethyl pentene film. A energy transmission test was performed using a meat as a phantom, a 4 MHz frequency and 500 Ω impedance power supply, a rectifying circuit and resistance load. Transmission electricity decreased to nearly 10% with 500 Ω load, however it remained in 80% with 5 Ω load. A cause of low transmission efficiency seems that the high frequency current passed through not only the resistance load but also the phantom. For improvement of the transmission efficiency, the electrode shape is resigning and the high frequency power supply impedance is adjusting.

Effects of blood volume on non-invasive assessment of peripheral perfusion with ventricular assist devices using a high speed CCD

Rotary blood pumps are commonly employed as circulatory support, which might cause changes in circulation in end organs. The purpose of this study was to develop a noninvasive and contactless system for measurement of peripheral perfusion by using a high-speed camera. A measurement system was designed to derive the amplitude of the green level (AGL). The static test of colour intensity was performed in vitro to verify the blood volume density in the materials. We employed a volume density model, which consisted of a polymer sponge under the different absorption condition using fresh goat blood. The sponge with blood was sandwiched between acrylic plates and the gap between them was varied by the linear table so that the density could be evaluated. The intensity of CCD data on the top flat plate was captured and analysed. As a result, the relationship between the density of blood and the CCD intensity could be evaluated under the LED lighting conditions. Therefore, it was indicated that the AGL could be reflected by the blood volume and the system by using a high-speed camera might be useful for measuring patients’ perfusion under the pump support condition.