

In-Vivo Experiments of an Electrohydraulic Ventricular Assist Device with
Magnetic Coupling

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We developed an electrohydraulic ventricular assist device with magnetic coupling. The integrated system consists of a blood pump, a water conduit for pressure transmission, a bellow type pumping sac, an actuator for transforming circular motion of a motor to linear motion of a pusher-plate attached to the pumping sac with a magnetic coupling, and a controller. The purpose of the coupling was to prevent excessive sucking against the atrial wall. Number 21 Medtronic Hall mechanical valves were used in the inflow and outflow ports of the blood pump. Maximum dynamic stroke volume was 48 ml, and against a mean afterload of 100 mmHg, maximum pump output was 7 L/min. Chronic in-vivo experiments were performed in three sheep, and during these evaluations the system showed no noticeable problems related to mechanical or electronic devices. When left atrial pressure decreased below 0 mmHg, the magnetic coupling system decoupled the pumping sac and pusher-plate with satisfactory reliability. The device was clinically applied in a postoperative patient with chronic dilating cardiomyopathy. In conclusion, the electrohydraulic ventricular assist system with magnetic coupling is a suitable ventricular assist device.