First human use of partial left ventricular heart support with the Circulite™ synergy™ micro-pump as a bridge to cardiac transplantation

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In March 2007, a 46-year-old man without prior medical history suffered a large anterior myocardial infarction. Despite successful restoration of patency of the left anterior descending artery, he was left with an overall ejection fraction of 15%. He developed NYHA Class IV symptoms within 2 months and was accepted for heart transplantation. However, he continued to deteriorate over the ensuing 6 weeks and was re-admitted for treatment of dyspnea at rest.

The patient met the inclusion and exclusion criteria for investigational study of the Synergy Micro-Pump (Circulite, Inc., Hackensack, NJ, USA). This pump is approximately the size of an AA battery, weighs only 25 g and can pump up to 2.5–3 L/min to provide partial left ventricular support. Its small size permits insertion via a right-sided mini-thoracotomy to withdraw blood from the left atrium (LA) with blood return to the subclavian artery. The pump is then placed subcutaneously in the pectoral region similar to a pacemaker (Panel A). Cardiac 64-slice computed tomography (CT) was performed on post-operative day (POD) 6 to evaluate the anatomic relationship between the Synergy system and the native patient structures. A three-dimensional (3D) reconstruction was created for a detailed evaluation of the 3D spatial relationship between the implanted system and patient anatomy (Panels B and C). The 3D reconstruction confirmed a correct position of the inflow cannula entering the left atrium at a predefined site between the right superior and right inferior pulmonary veins, leaving 2.9 cm distance towards the posterior LA wall as to avoid opposite wall suction (Panels D and E). The patient was fully ambulatory by POD 7. Intrinsic cardiac output of the LV evaluated by echo-Doppler on POD 13 off inotropic support (3.6 L/min) was greater than the preoperative value (2.6 L/min). Combining an intrinsic cardiac output of 3.6 L/min with the 2.5 L/min provided by the pump, sums to a total cardiac output in excess of 6 L/min, a normal resting value. There were no serious adverse effects.

The patient was discharged on POD 17 after patient and family education and proper preparation of the home environment. Exercise capacity further improved at home. He underwent successful heart transplantation 10 months later, in January 2008.

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