

Two years and 4 months: A long-term bridge to transplantation with a total artificial heart

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We report our experience with a 38-year-old man with refractory end-stage biventricular heart failure due to an idiopathic dilative cardiomyopathy, who received a SynCardia temporary total artificial heart (SynCardia Systems, Inc., Tucson, AZ) as treatment. This procedure performed at our institution is the longest term bridge to heart transplantation (HTx) so far.

For this patient the pre-operative Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) level was 2. Right ventricular function and geometry were evaluated according to the University of Pennsylvania algorithm (score >55)¹ and Berlin decisional echocardiographic parameters (severe tricuspid regurgitation, right ventricle short/long-axis ratio >0.65 , right/left ventricular end-diastolic ratio >0.72).²

The total artificial heart (TAH) system was conventionally implanted³ and activated by the “big blue” circulatory support system driver.

The device rapidly stabilized the patient’s hemodynamics and provided full recovery of end-organ function. Intensive care unit time was 32 days. Thromboelastometry analysis (ROTEM; Tem International GmbH, Munich, Germany) and platelet aggregation profiler (Model PAP-8E) monitoring data were adopted for anti-coagulation management.

On Day 91 post-operatively the patient was switched to the Berlin Heart Excor portable driver and, on Day 123, he was discharged home. Anti-coagulation was targeted to an international normalized ratio of 3.0 to 3.5 with warfarin and 150 mg of aspirin every 12 hours.

The patient rejoined his family, met his friends, and drove his car in the city, thus gaining an acceptable quality of life (Figure 1). He returned to our institution for routine follow-up every 15 days.

On Day 815 post-operatively a transient ischemic attack event occurred and he was re-admitted to hospital to start heparin drip and listed for urgent HTx. He rapidly recovered and, at the time of switching to the novel portable Freedom driver, 17 days after hospital re-admission, a matching donor organ became available and transplant surgery was successfully performed. Thirty-seven days after HTx he was discharged home and has since returned to normal activity (Figure 1).

More than 900 SynCardia temporary TAHs have been implanted to date, with a bridge-to-transplant success rate of $>79\%$ and a reported maximum duration of support of 602 days.³ Moreover, utilization of Excor and Freedom drivers has significantly enhanced patient mobility and made home discharge of patients possible.



Figure 1 (A1, A2) G.N., our total artificial heart (TAH) patient, fully mobilized, using a Berlin Heart Excor portable driver to power his TAH. (B) G.N. after transplantation. He became the first TAH patient to be successfully transplanted after 832 days.

The present case resulted in being the first successful HTx to take place at beyond 832 days of TAH support, thus encouraging the adoption of such a fully implantable device for similarly long periods of support. The demand for longer duration device support is a result of the lack of donor organs.

We believe that adequate training of the patient in the care of equipment and batteries, accurate anti-coagulation management, frequent drive-line wound dressing, close patient follow-up, and availability of 24-hour call service by the referring care hospital are essential components in successful long-term TAH support. Moreover, by adoption of long-lasting polymer systems for TAH fabrication, the utilization of TAH therapy as an alternative to HTx is a strong possibility in the near future.

Disclosure statement

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