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Current ventricular assist device outcomes and future technology

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Abstract

Heart failure (HF) remains to be a global problem with approximately 5.7 million individuals suffering from heart failure in the US alone. Heart transplantation has been the gold standard with good and predictable long term outcomes, but its applicability has been limited by the number of available donors. This has stimulated the advancement of mechanical circulatory support as an alternative to improve survival and quality of life in patients suffering from late stage congestive heart failure. First generation pulsatile-flow left ventricular assist devices (LVADs) were able to demonstrate improved survival to transplantation compared to the standard treatment of intra-aortic balloon pump and inotrope and improved survival in non-transplant eligible patients compared to optimal medical management. The second generation LVAD, i.e. the axial continuous-flow LVAD, has demonstrated tremendous improvement in patient survival and better durability with less complications and smaller in device size. Recent data from trails with the second generation continuous flow LVAD implanted as bridge-to-transplantation therapy demonstrate a survival rate approaching 90% at one year, similar to the heart transplantation survival. The improvement in outcomes has also been achieved in patients not eligible for transplant as destination therapy with similar survival to transplantation out to two years. The third generation centrifugal continuous-flow LVADs with noncontact bearings, have a significant improvement in technology and reduction in pump size with less device-related complications and improved patient outcomes. One of the third generation LVADs has been approved by FDA recently to be used as bridge-to-transplant therapy for heart failure patients with destination therapy approval pending and coming soon. Significant amount of intensive research is currently underway with multiple smaller devices and the possibility of driveline elimination with the transcutaneous energy transmission technology will likely further reduce the device-related complication significantly and improve patient outcomes. Minimal invasive off-pump LVAD implantation has been shown possible and will further increase the application of the mechanical circulatory support devices to an even larger patient population. The development of implantable LVADs has revolutionized the treatment of late-stage heart failure and its continuous advancement will open door to a large market of potential recipients with improved durability, cost and effectiveness.

Biography

Allen Cheng completed his general surgery residency at UCLA and postdoctoral fellowship at Stanford University. He then completed his cardiothoracic surgery training at Massachusetts General Hospital in Boston and pursued further training at University of Rochester specializing in mechanical circulatory support and transplantation. He is currently an attending cardiac surgeon with Dr. Mark Slaughter at University of Louisville, specializing in mechanical circulatory support and heart transplantation. He has published numerous papers in major journals and is a reviewer for multiple journals. He is also an investigator at the Cardiovascular Innovation Institute very active in ventricular assist devices research supported by multiple NIH grants.