

## Editorial

## The Minimally Invasive Approach to Left Ventricular Assist Device Implantation: Is Smaller Better?



## Cirugía mínimamente invasiva para la implantación de dispositivos de asistencia ventricular: ¿es siempre recomendable?

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Left ventricular assist device (LVAD) support is an effective therapy for patients suffering from end-stage heart failure.<sup>1</sup> The concept was first introduced into mainstream health care in 1994 with the Food and Drug Administration approval of the Thoratec HeartMate I device.<sup>2</sup> First-generation devices were bulky, due to the multiple moving parts necessary to generate pulsatility and required intra-abdominal implantation to accommodate the large size of the device.<sup>3</sup> Second-generation devices introduced the concept of continuous flow, thus allowing for smaller and more durable pumps.<sup>4</sup> These more compact devices allowed for intrathoracic or subcutaneous pocket implantation, which, in turn, allowed for expansion of this therapeutic option to a broader patient population, including women and some children. Initially, all devices were implanted via a standard median sternotomy. This approach was the standard of care until Hill et al.<sup>5</sup> introduced the concept of implantation of a Thoratec paracorpeal LVAD via a right mini-thoracotomy and left subcostal incision in a small series of 3 patients. Subsequently, Gregoric et al.<sup>6</sup> described implantation of a Thoratec HeartMate II LVAD using a subcostal and parasternal mini-thoracotomy. Referred to as the “Hannover technique”, Schmitto et al.<sup>7</sup> described the use of an anterolateral thoracotomy and upper hemisternotomy for implantation of the HeartWare HVAD.

The article by the Hannover group recently published in *Revista Española de Cardiología* describes a prospective study of 46 patients with heart failure who underwent HVAD implantation as destination therapy.<sup>8</sup> There were 2 arms: a conventional approach with full median sternotomy and a minimally-invasive approach with an anterolateral thoracotomy and hemisternotomy. Outcomes are reported up to 2 years. There was no difference in 2-year survival between the 2 groups; however, there was a significantly lower incidence of extended inotropic support and bleeding in the minimally-invasive group. The authors conclude that a minimally-invasive approach offers a

decreased adverse event rate for postoperative bleeding and inotrope use and has a trend toward lower mortality.

Minimally-invasive LVAD placement has been championed by the Hannover group, and again, they present the most comprehensive study to date comparing mid-term outcomes of their surgical approach. While the results of the study are encouraging, they are by no means definitive. A less invasive approach does seem to offer some benefits in their patient population, but there is no obvious survival benefit. Quality of life, not addressed by this study, may be a more important but less quantifiable objective. With any study that is not randomized, there is always the concern that there is some subtle selection bias that can significantly affect outcomes, which is a concern here as well. Finally, the study only includes destination therapy patients, and the results may not be applicable in the younger and generally less sick bridge-to-transplant patient population.

Cardiac surgery has been progressing toward decreasing invasiveness, particularly with valve surgery, off-pump coronary artery bypass grafting, robotic surgery, and transcatheter-based therapies.<sup>9</sup> Overall survival outcomes have been similar to those of a traditional sternotomy approach but have similar trends of shorter length of hospital stay and decreased bleeding. Specifically for ventricular assist devices, there has been a movement toward reducing invasiveness that has paralleled the miniaturization of devices. Survival outcomes are comparable to the full open approach but may show improvement in blood loss and length of hospital stay similar to outcomes for less invasive strategies for valve and coronary surgery.<sup>10</sup> In a study performed by Schechter et al., patients who underwent minimally invasive LVAD implantation had improved early survival.<sup>11</sup> More recent data using an off-bypass technique has the theoretical advantage of reducing the derangement of the clotting cascade that is inherent to cardiopulmonary bypass, and early results show significantly less bleeding and transfusion requirement during the perioperative period.<sup>12</sup> These early results may ultimately demonstrate reduction of long-term complications related to bleeding events and thrombosis; however, this has not yet been studied.

While the initial outcomes are encouraging, there is no definitive evidence that a minimally invasive approach is superior to median sternotomy. In fact, the growing worldwide experience with LVAD implantation seems to suggest that the approach

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should be individualized for each patient.<sup>13</sup> A “less invasive” approach is certainly a useful technique for the cardiac surgeon performing ventricular assist device implantation, but we do not currently have the appropriate tools to perform a less invasive approach in all patients. As technology continues to progress with ventricular assist devices, implantation techniques and dedicated tools will continue to improve, and ultimately, will lead to improved outcomes for patients with advanced heart failure. While studies so far have proven that it is feasible and, in general, safe, more data, especially for long-term outcomes must be gathered to allow conclusions to be drawn on the usefulness of less invasive ventricular assist device implantation.

#### CONFLICTS OF INTEREST

None declared.

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