

Minimally invasive left ventricular assist device implantation: at the crossroads

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Continuous-flow left ventricular assist devices (CF-LVADs) are now established therapy for end stage heart failure, as not only bridge to transplant/recovery/decision but also as destination therapy. What remains somewhat divisively opinionated, however, is the optimal approach—is full sternotomy still the “standard of care” or are minimally invasive techniques making “smaller, yet safer” the new norm for LVAD implantation in appropriate patients? In this article (1), Maltais and colleagues review their single-center experience with minimally invasive CF-LVAD implantation.

Like any systematic change from ‘the old way to the new’, minimally invasive LVAD implantation has its share of detractors with justifiable concerns. Significant learning curves, limited availability, limited applicability and perhaps, more often than admitted, an underlying wariness about safety—these are a few reasons that might make it difficult for even otherwise savvy surgeons to embrace minimally invasive techniques. The fact that LVADs are implanted in patients who are often ‘at the end of the road’ throws another spanner in the works: “is it worth laboring with smaller incisions or should we just keep things simple and get on with it—the patient is not here for cosmetic surgery, anyway!” LVADs are a complex therapeutic modality defined by highly sophisticated engineering, integrating moving components with blood-surface interaction and controllers designed to mimic physiological responses. Thus, the surgical implantation of LVADs is highly specialized, requiring expertise and collaboration on the part of the surgeons, anesthesiologists, perfusionists and nurses. Consequently, any deviation from the “comfort zone” of a full sternotomy may initially be

disconcerting for not only the surgeon, but also the other members of the operative team. Small thoracic incisions may make direct access to the LV apex technically more challenging and result in improper placement of the inflow cannula. Similarly, limited exposure/access to the ascending aorta may encumber emergent cardiopulmonary bypass (CPB) if needed. Nevertheless, less invasive alternatives to standard sternotomy were developed primarily with the hopes of reducing CPB time and operative trauma, minimizing perioperative blood loss, protecting cardiac structures from multiple re-entries, and increasing thoracic compliance (2). Technological advances and progressive miniaturization of devices have helped optimize improve learning curves and outcomes, with previously anecdotal reports now giving way to routine minimally invasive LVAD implantations at many centers, including ours. We believe that routine implementation engenders a protocol-driven approach and demystifies matters. Maltais *et al.* describe their institutional protocols and practical considerations for minimally invasive LVAD implantation. Their article gives a comprehensive overview reflective of current practice, along with pertinent caveats. However, preferred techniques or protocols understandably differ between different centers or even between different surgeons in the same center e.g., off-pump *vs.* on-pump, use of adenosine *vs.* rapid ventricular pacing in off-pump implantation, upper hemi-sternotomy *vs.* complete sternal sparing, bilateral *vs.* left single thoracotomy, site for outflow-graft anastomosis [ascending aorta *vs.* descending aorta *vs.* subclavian artery, and recently, even the innominate artery (3)], etc., and no single method/technique has hitherto been shown

to be superior to another. Our group does not believe in hemi-sternotomy—we do either a full sternotomy or we spare the sternum, but not half way, either way. We routinely use bilateral limited thoracotomy (4) and have recently started implanting LVADs with only a single left thoracotomy incision (5). Nevertheless, irrespective of the exact technique/method employed, evidence for the safety and feasibility of minimally invasive LVAD implantation continues to grow, with recent studies (6,7) documenting non-inferior (mortality) or even superior (inotropes, transfusion requirements) outcomes as compared to conventional sternotomy.

Going forward, we believe that “full sternotomy unless proven otherwise” is on the way to being replaced by “minimally invasive unless indicated otherwise”. Evidence of feasibility and safety of minimally invasive LVAD implantation in appropriate patients is already in place, and outcomes will continue to improve with refinement of technology and practice-based learning and development. For those of us still in two minds about conventional versus minimally invasive LVAD implantation, the question we must ask ourselves is: “If I were at the other end of the scalpel, what would I want for my myself?”.

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