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The Opportunity for Increased Quality of Care and Shared Savings With the Impella® Heart Pump

BY CHARLES SIMONTON, MD

Cardiovascular disease has been the number one cause of death in the United States since 1920.[1] In 2016, cardiovascular disease cost $555 billion and is expected to grow to $1.1 trillion by 2035, according to the American Heart Association.[1] Heart failure and recurrent cardiac symptoms are the leading causes of medical readmissions among the Medicare population,[2] with rates > 50% at 6 months.[3]

Over the last decade, there has been an increase in the use of percutaneous ventricular assist devices (pVADs), specifically the Impella 2.5® and Impella CP® (Abiomed, Inc.), which have demonstrated significant reductions in major adverse clinical events in patients undergoing high-risk percutaneous coronary intervention (PCI).[4] This has resulted in cost savings and cost-effectiveness for payers and providers in multiple studies and economic models, namely in reduced length of stay (LOS) and reduced readmissions from repeat procedures.[5-8]

> **"Sometimes trying to save costs by avoiding or delaying the use of innovative technologies sounds good, but you delay safe and effective therapy. Then the patients are sicker, and their outcomes are worse, which ends up being more costly for the patient and the health care system. Using a better therapy up front can give you a better long-term outcome while reducing cost."**
>
> –George Vetrovec, MD, professor emeritus, Virginia Commonwealth University

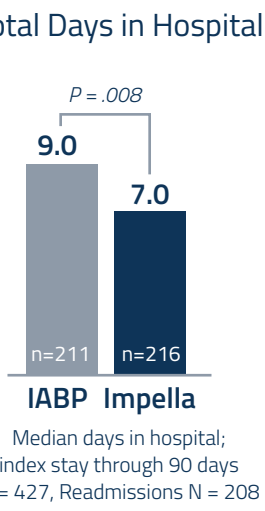

Figure 1. LOS reduction observed in PROTECT II randomized controlled trial.

The PROTECT II Economic Study concluded that for patients with severe left ventricular dysfunction and complex anatomy, Impella-assisted high-risk PCI significantly reduced major adverse events at an incremental cost per quality-adjusted life-year (QALY), referred to as ICER (incremental cost-effectiveness ratio), of $39,000/QALY, which is considered to be cost-effective for advanced cardiovascular technologies.[4]

In the 90 days after initial hospitalization, Impella patients experienced:

- Two fewer days in the hospital (P = .008)[4] (Figure 1)
- A 52% reduction in hospitalizations due to repeat revascularization (P = .024)[4]
- 50% lower rehospitalization costs compared to the intra-aortic balloon pump (IABP) (P < .001)[4]

The national upward trend in the utilization of pVADs and other short-term mechanical support reported by Stretch et al[5] observed a correlation between increased utilization of pVADs and decreased costs.

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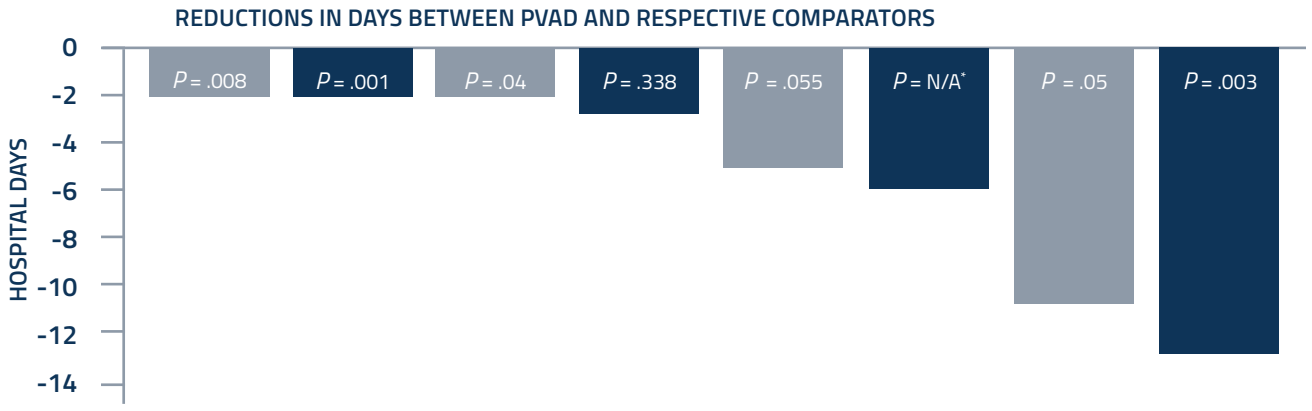

Figure 2. Hospital LOS findings associated with pVAD use.

REDUCTION IN LOS

A systematic review by Maini et al[8] reported the findings of several cost-effectiveness studies of pVADs. Reductions in LOS were observed in all studies (Figure 2), with a clinically relevant observation of fewer days in the intensive care unit and fewer readmissions. As such, they concluded pVAD use, specifically Impella 2.5, is a high-value technology in an era of accountable care.

A budget impact model supports these and other studies showing patients receiving Impella support had a 2-day reduction in LOS, or 18% in the nonemergent care model, compared to those in the IABP arm. In the emergent setting, patients in the pVAD arm demonstrated an average of 10.5 days' reduction in LOS, or 34% (Figure 3).[6]

COST SAVINGS

Research published by Maini and colleagues also evaluated the cost-effectiveness of pVADs in an emergent setting compared with traditional surgical hemodynamic support alternatives. For patients in cardiogenic shock requiring emergent hemodynamic support, Impella 2.5 resulted in better outcomes, shorter LOS, lower costs, and a survival benefit when compared with surgical hemodynamic support alternatives (Table 1).[9]

With a negative, or dominant, ICER of -$134,932/life-year gained, Impella therapy not only improved outcomes but resulted in a cost savings in acute myocardial infarction patients with cardiogenic shock in this study.[8]

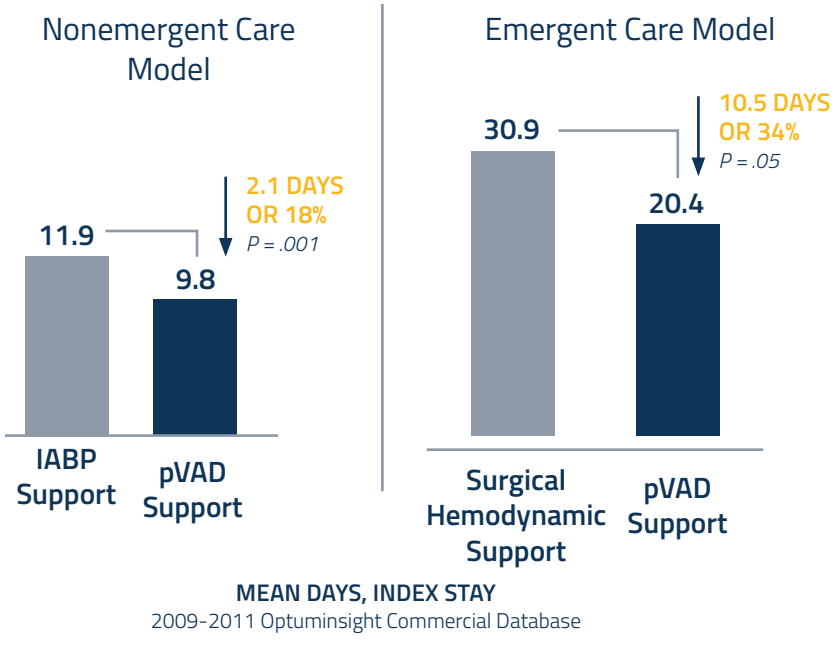

Figure 3. Impella demonstrates reduced LOS.

TABLE 1. SURVIVAL, COST, AND LENGTH OF STAY BENEFITS OF IMPELLA 2.5 VERSUS SURGICAL ALTERNATIVES

Outcome Measure	Impella 2.5	Surgical Alternative	*P* Value
Survival rate at discharge	56%	42%	*P* < .001
Cost	$112,340	$158,218	*P* < .001
Length of stay (d)	13.2	17.9	*P* = .055

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Most recently, Vetrovec and colleagues demonstrated that the use of the Impella pVAD is associated with reduced mortality rates, shorter LOS, and lower hospital costs compared to extracorporeal membrane oxygenation (ECMO) in patients with acute myocardial infarction and cardiogenic shock. pVAD use compared to ECMO resulted in total episode-of-care savings of $54,571.[10]

CONCLUSION

It is possible that new, minimally invasive technologies, such as the Impella pVAD, can provide the opportunity to concomitantly improve clinical outcomes, quality of care, and shared savings opportunities for patients and providers. As the heart failure population grows due to longer survival of patients with ischemic heart disease after revascularization procedures such as PCI, understanding the need to balance short-term costs of procedures versus the long-term savings associated with ongoing care and long-term improvement in outcomes will be key. ■

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