Is There an Association Between Living in a Rural Area and the Incidence of Postoperative Complications or Hospital Readmissions Following Left Ventricular Assist Device (LVAD) Implantation, Compared to Urban LVAD Recipients?

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A left ventricular assist device, commonly referred to as a LVAD, is a battery powered device that aids in pumping blood out of the lower left ventricle to the rest of the body. The inflow cannula portion of the LVAD is attached to the left ventricular apex. Blood from the lungs enters the left side of the heart where the LVAD device pumps the blood through the outflow canal into the ascending aorta where it is then distributed to the rest of the body. The pump and battery are controlled outside of the body and the driveline portion enters the skin to control the device.

LVADs are particularly helpful in patients with end-stage heart failure. In the United States, over 6.5 million people have heart failure and this number continues to grow. Due to lengthy transplant lists and organ availability, LVADs are shown to have a 1-year survival of 84%. This is a substantial increase in comparison to the 53% 2-year survival rate in heart failure patients on medical therapy. Despite increased patient and physician education, as well as advancements in the actual LVAD mechanics, up to 50% of patients will experience an LVAD related complication by six months post surgery. Complications of LVAD implantation are well documented and studied. Approximately 50-80% of patients experience bleeding requiring blood transfusion, 30% of patients experience bleeding requiring reoperation, and 50% of patients will contract infections. Additionally, there is a 2-9% rate of pump thrombosis, 15-25% rate of right heart failure, and 10-15% rate of stroke. As LVAD implantation rates continuously grow, it is increasingly important that complications are monitored in all capacities. To date, there are few studies examining the epidemiological factors affecting complication rates due to LVAD transplantation. Rural populations, areas with fewer than 2000 housing units and 5000 residents, are more likely to experience health problems and are less likely to have medical services available to them. In contrast, urban, population areas with greater than 2000 housing units and 5000 residents, have greater access to medical services and physicians. This review compares rates of adverse effects due to LVAD implantation in rural hospital settings versus urban hospital settings.

Is there an association between living in a rural area and the incidence of postoperative complications or hospital readmissions following left ventricular assist device (LVAD) implantation, compared to urban LVAD recipients?

Rajagopalan (2020) and Alonso, Faulkner (2018) found that rural LVAD recipients have a 15% rate of stroke. As LVAD implantation rates continuously grow, it is increasingly important that complications are monitored in all capacities. To date, there are few studies examining the epidemiological factors affecting complication rates due to LVAD transplantation. Rural populations, areas with fewer than 2000 housing units and 5000 residents, have greater access to medical services and physicians. This review compares rates of adverse effects due to LVAD implantation in rural hospital settings versus urban hospital settings.

Introduction

The aim of this systematic review is to evaluate whether rural left ventricular assist device (LVAD) recipients have a higher risk of adverse events and hospitalizations compared to their urban counterparts.

Methods

Identification of studies via databases and registers

<table>
<thead>
<tr>
<th>Author Year</th>
<th>Title</th>
<th>Methodology</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Alonso, Kibis (2016)</td>
<td>Rural-Urban Comparison of LVAD-Related Hospitalization Rate and Survival to the Month Following Device Implantation</td>
<td>Data from the “VAD Registry” was used to examine hospitalization and survival rates among rural and urban LVAD recipients.</td>
<td>811 total VAD recipients; 7 deaths during study; 46% in rural vs 44% urban; rural patients have higher rates of hospitalization and mortality (not statistically significant).</td>
</tr>
<tr>
<td>Alonso, Kibis (2016)</td>
<td>A Longitudinal Comparison of Health-Related Quality of Life in Rural and Urban LVAD Recipients</td>
<td>Data from the “VAD Registry” was used to examine health-related quality of life in rural and urban LVAD recipients.</td>
<td>100 total VAD recipients; 7 deaths during study; 46% in rural vs 44% urban; rural patients have higher rates of hospitalization and mortality (not statistically significant).</td>
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</table>

Discussion

The sources collectively suggest that both rural and urban LVAD recipients face challenges post-implantation, with rural recipients potentially at higher risk for post-implantation hospitalization, while urban patients may face a higher mortality rate. Specific adverse events, such as gastrointestinal bleeding, ventricular arrhythmias, LVAD complications, and stroke, are more prevalent in rural patients. Despite these challenges, survival rates and heart transplantation outcomes at 1 year are similar between rural and urban recipients. However, rural patients exhibit a higher driveline infection rate at 1 year. Overall, the data highlight the need for closer management and ongoing resource assessment for all LVAD recipients, regardless of their place of residence, and highlight the potential benefits of telehealth, mobile health, and remote monitoring in managing complications and avoiding hospitalizations.

Conclusion

The association between living in a rural area and the incidence of postoperative complications or hospital readmissions following LVAD implantation is not definitive, the sources suggest that rural recipients may face unique challenges. Further research is needed to fully understand the interplay between place of residence and LVAD outcomes. These findings however may emphasize the importance of tailored interventions and close monitoring for rural LVAD recipients to improve their overall outcomes and quality of life.

Longer and larger studies following both cohorts will be essential to truly understand the relationship between adverse events/hospitalizations between rural and urban LVAD recipients.

References

Alonso, et al. (2020) "A Longitudinal Comparison of Health-Related Quality of Life in Rural and Urban LVAD Recipients". "Urban LVAD recipients exhibit a higher driveline infection rate at 1 year. Overall, the data highlight the need for closer management and ongoing resource assessment for all LVAD recipients, regardless of their place of residence, and highlight the potential benefits of telehealth, mobile health, and remote monitoring in managing complications and avoiding hospitalizations."