

# Ventricular Arrhythmias Following Left Ventricular Assist Device Placement: Can We Predict Them

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## **AIMS:**

With the growing number of patients suffering from heart failure worldwide and the short supply of donor hearts for transplantation, left ventricular assist devices (LVAD) remain an option and a well-established treatment for patients with advanced heart failure. One of the main problems facing LVAD, however, is the high prevalence of ventricular arrhythmias after their implantation<sup>1</sup>.

The aim of this review is to:

- Identify the main risk factors of ventricular arrhythmias post LVAD implantation.
- Identify the likelihood of the occurrence of VA in those patients.

Identifying risk factors and predictors of ventricular arrhythmias in patients undergoing left ventricular assist devices can potentially, then, decrease mortality post LVAD implantation. In addition, it can guide future indications for implantable cardioverter devices for patients as a measure of secondary prevention.

## **METHODS:**

Literature research was done on PubMed, Web of Science, Cochrane, and Scopus in March 2022. The following combined terms were used: “LVAD” or “left ventricular assist device” or “heart assist device” and “ventricular arrhythmia” or “arrhythmia,” “ventricular tachycardia,” or “ventricular fibrillation” as either keywords or MeSH terms. Studies were then reviewed for their relevance and non-relevant ones were excluded. The total number of patients in this systematic review is 3222, among them 2430 did not have VA following LVAD implantation and 792 did.

angiotensin converting enzyme inhibitors (ACEI) use after implantation, idiopathic cardiomyopathy, and heart failure of more than 12 months duration. In addition, Galand et al suggested that early VA less than 30 days after LVAD implantation can be a risk factor of late VA<sup>2-14</sup>.

Greet et al found that prior cardiac surgery, in particular coronary artery bypass graft surgery, was a risk factors of VA<sup>2</sup>, and Rehorn et al found that ventricular tachycardia ablation and the use of antiarrhythmics before LVAD to be a risk factor for the development of late VA<sup>3</sup>. We also identified through the results in 10 studies that diabetes mellitus was also a risk factor for patients to have VA post LVAD implantation with odds ratio of 1.2. Enriquez et al uniquely found that perioperative mechanical circulatory support was a risk factor for the development of electrical storm<sup>15</sup>.

Bohonos et al in a case study mentioned an interesting correlation between preload deficiency and ventricular tachycardia, and Terzic et al found that kinking of the outflow graft led to ventricular tachycardia<sup>16</sup> In addition, they also found in their case study that any attempt to surgically correct this kinking led to a greater frequency of ventricular tachycardia<sup>17</sup>.

Many other predictors were investigated including basic demographics and comorbidities including age, sex, arterial hypertension, dyslipidemia, and even the type of LVAD used, but none were statistically significant to indicate a higher incidence of VA between groups. The vast majority of studies were conducted with a significant male predominance among cases, which made differentiation between sexes less accurate.

## RESULTS:

Thirteen studies were included in this review, The combined odds ratio showed that the greatest predictor of VA post LVAD implantation was VA before implantation. Two studies also showed that such ventricular arrhythmias were associated with increased mortality<sup>2,3</sup>. In addition, other independent risk factors included atrial fibrillation before LVAD, the lack of reflect the complex nature of VA following LVAD.

VA ablation also remains a viable option for many patients before LVAD placement, and to guide the indications for its use, it is important to balance its benefits against risks which have been reported to include the risk of pump thrombosis, although it is

## CONCLUSIONS:

Identifying risk factors of VA before LVAD implantation can guide future indications of implantable cardioverter device (ICD) in patients who did not have it before. Although a large number of patients have ICD by the time of LVAD placement, the placement of ICD before for patient who did not have it before remains an uncertain subject, and studies like the ones mentioned here will guide decision making in those patients and worth mentioning that the number of studies

suggesting it is scarce<sup>18</sup>. Further studies would also be beneficial to identify other risk factors and predictors including those related to medications taken before LVAD implantation, and other comorbidities such as ischemic heart disease.