

Surgical VT ablation during LVAD Implantation

VT symposium 2019

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SAMSUNG MEDICAL CENTER

A large square icon with a yellow border and a dark grid background. In the top-left corner, there are two small squares, one blue and one yellow. The word "Contents" is written in yellow text in the center.

Contents

01

Overview of VT in LVAD

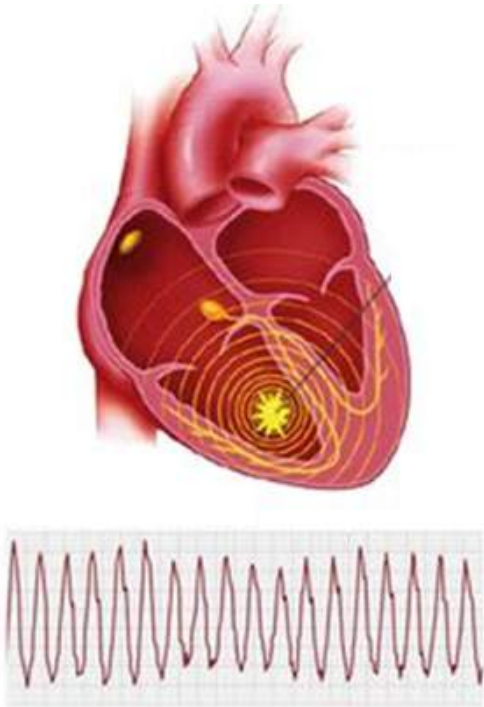
02

VT management in VAD

03

Clinical experience of SMC

VT and LVAD



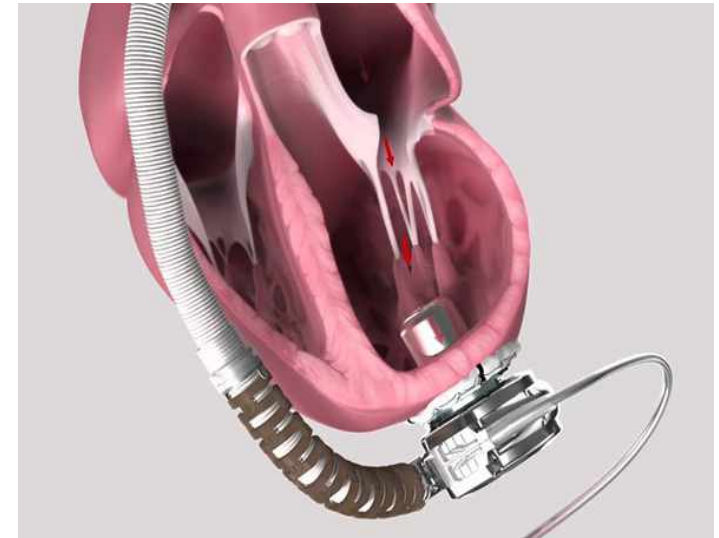
Ventricular arrhythmia

Ventricular decompression



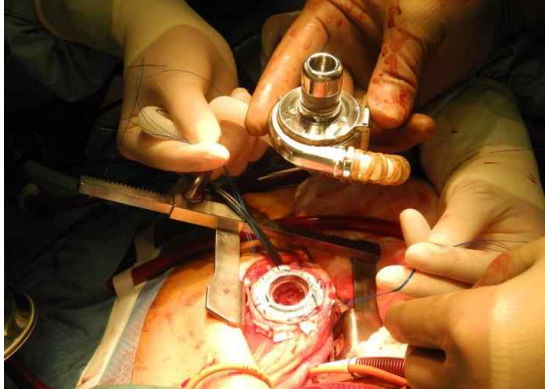
VAD- related VT

- 22-59%
- Previous history of VA
- Bi-VAD type
- Continuous flow pump

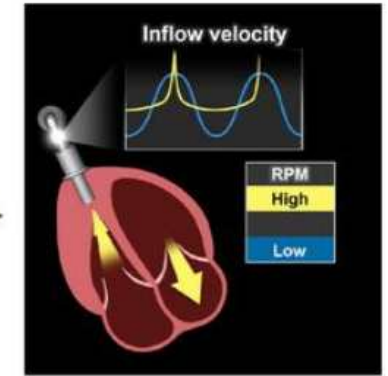
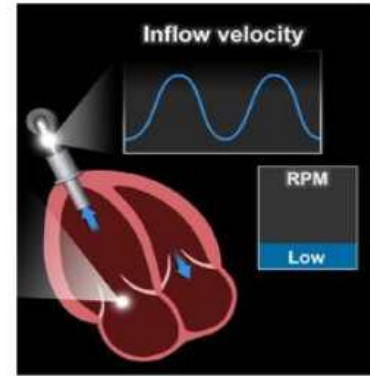


Left Ventricle Assist Device

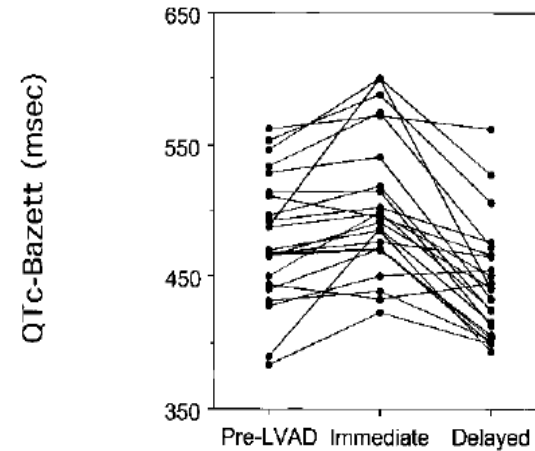
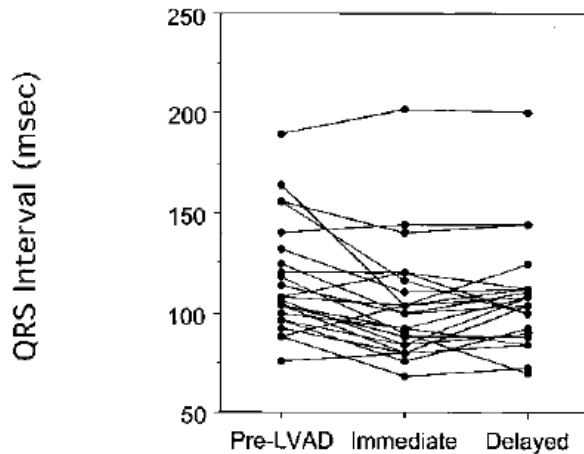
Potential Mechanisms of VT



Myocardial scar at VAD inflow cannula site



LVAD suction event



Acute mechanical unloading of left ventricle*

* Harding JD et al. Circulation. 2001;104:1241-1247

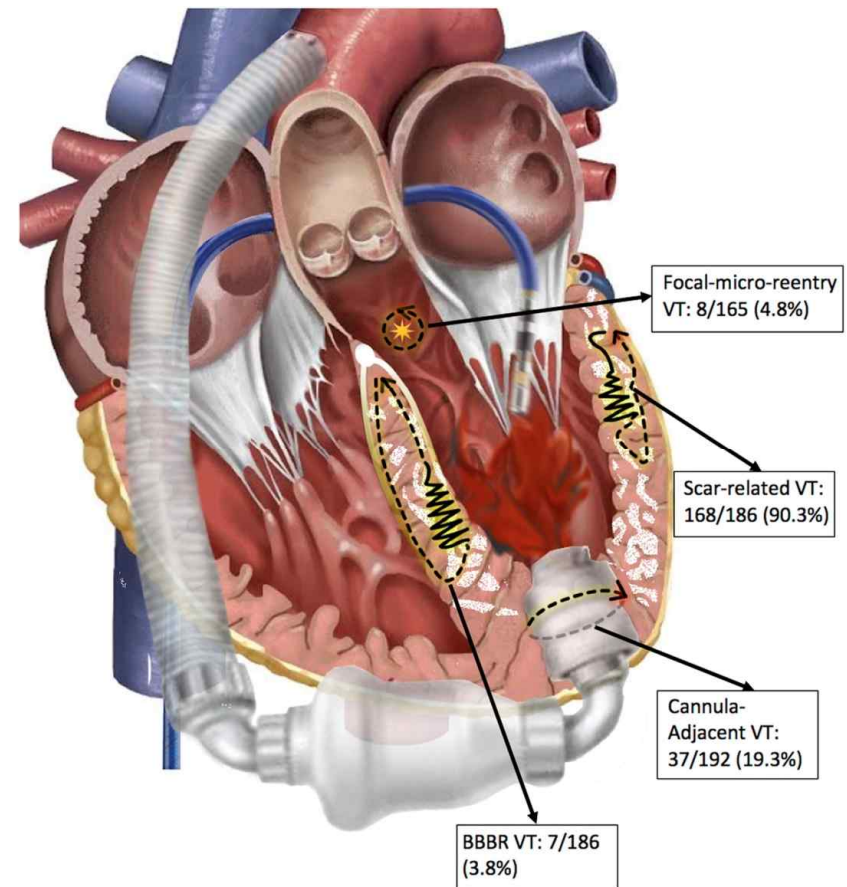
Potential Mechanisms of VT

Catheter Ablation of Ventricular Tachycardia in Patients With a Ventricular Assist Device

A Systematic Review of Procedural Characteristics and Outcomes

Robert D. Anderson, MBBS,^a Geoffrey Lee, MChB, PhD,^a Sohaib Virk, BMED/MD,^b Richard G. Bennett, MChB,^c Christopher S. Hayward, BMEDSc, MD,^d Kavitha Muthiah, MChB, PhD,^d Jonathan Kalman, MBBS, PhD,^a Saurabh Kumar, BSc(MED)/MBBS, PhD^{b,e}

- Systemic review (18 papers)
- 110 patients (VT storm;34%)
- LVAD type (72 cases Heart Mate II)
- 47 patients for destination therapy
- **Pre-existing intrinsic myocardial scar > Cannula inflow site**



Anderson et al "Catheter ablation of VT in patients with VAD JACC EP 2019;5:39-51

VT influence after LVAD

Early Ventricular Arrhythmias After LVAD Implantation Is the Strongest Predictor of 30-Day Post-Operative Mortality

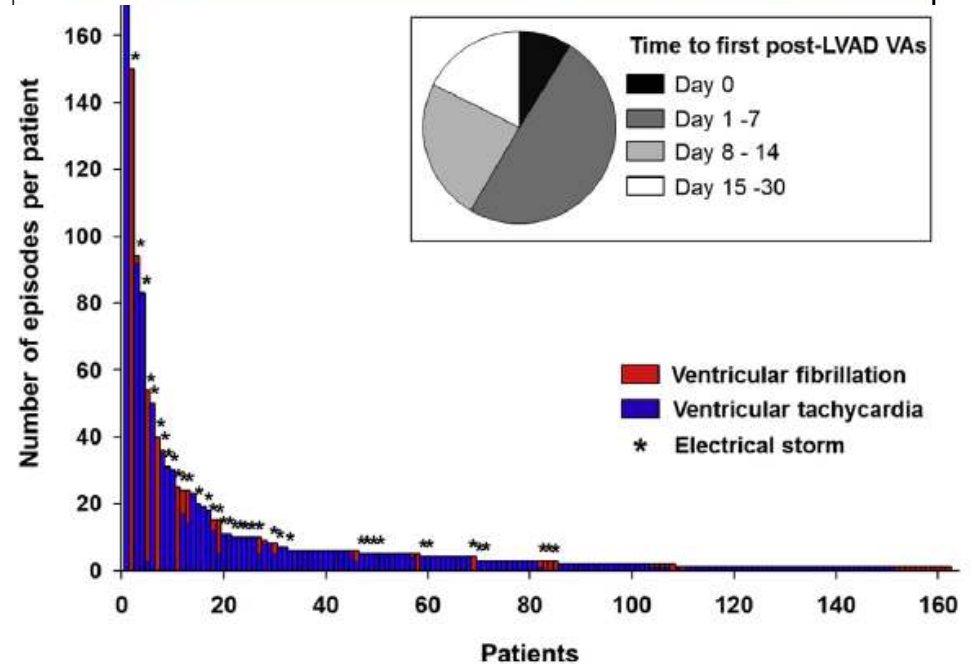


Vincent Galand, MD,^a Erwan Flécher, MD, PhD,^a Vincent Auffret, MD,^a Camille Pichard, MD,^a Stéphane Boulé, MD,^b André Vincentelli, MD, PhD,^b Anne Rollin, MD,^c Pierre Mondoly, MD,^c Laurent Barandon, MD, PhD,^d Mathieu Pernot, MD,^d Michel Kindo, MD, PhD,^e Thomas Cardi, MD,^e Philippe Gaudard, MD,^f Philippe Rouvière, MD,^f Thomas Sénage, MD,^g Nicolas Jacob, MD,^g Pascal Defaye, MD,^h Olivier Chavanon, MD, PhD,^h Constance Verdonk, MD,ⁱ Walid Ghodbane, MD,ⁱ Edeline Pelcé, MD,^j Vlad Gariboldi, MD, PhD,^j Matteo Pozzi, MD,^k Jean-François Obadia, MD, PhD,^k Arnaud Savouré, MD,^l Frédéric Anselme, MD,^l Gerard Babatasi, MD, PhD,^m Annette Belin, MD,^m Fabien Garnier, MD,ⁿ Marie Bielefeld, MD,ⁿ David Hamon, MD,^o Nicolas Lellouche, MD, PhD,^o Bertrand Pierre, MD,^p Thierry Bourguignon, MD,^p Romain Eschalier, MD, PhD,^q Nicolas D'Ostrevy, MD,^q Marie-Cécile Bories, MD,^r Eloi Marijon, MD, PhD,^r Fabrice Vanhuyse, MD,^s Hugues Blangy, MD,^s Jean-Philippe Verhoye, MD, PhD,^a Christophe Leclercq, MD, PhD,^a Raphaël P. Martins, MD, PhD^a

- 19 centers between 2006 and 2016
- 652 patients (Heart mate II 72.8%/ HeartWare 19.5%)
- Early VA occurred **162 patients (24.8%) at 1 week after LVAD.**
- **7-fold** increase of 30-day mortality.
- Early VA **did not influence long-term survival.**

TABLE 2 Multivariable Analysis for Risk Prediction of Early VAs

	β Coefficient	OR (95% CI)	p Value
Body mass index, kg/m ²	0.028	1.03 (0.99-1.07)	0.186
Heart failure duration, months	0.001	1.00 (0.99-1.00)	0.831
LVFDD prior to LVAD, mm	0.012	1.01 (0.99-1.03)	0.103
VAs prior to LVAD	0.859	2.36 (1.57-3.56)	<0.001
ICD prior to LVAD	0.115	1.12 (0.69-1.82)	0.639



Galand et al " Early ventricular Arrhythmia after LVAD implantation is the strongest predictor of 30-day postoperative mortality " JACC EP 2019;5:944-54

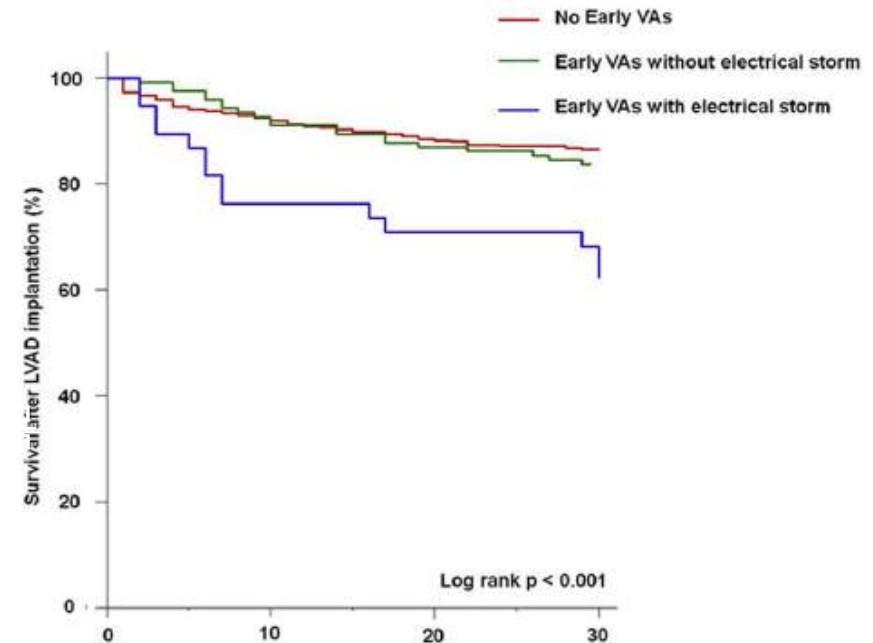
VT influence after LVAD

Early Ventricular Arrhythmias After LVAD Implantation Is the Strongest Predictor of 30-Day Post-Operative Mortality



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Number at risk	Follow up (days)			
	0	10	20	30
Early VAs and AS	39	31	25	24
Early VAs and no AS	123	116	108	104
No early VA	490	450	429	417

Galand et al " Early ventricular Arrhythmia after LVAD implantation is the strongest predictor of 30-day postoperative mortality " JACC EP 2019;5:944-54

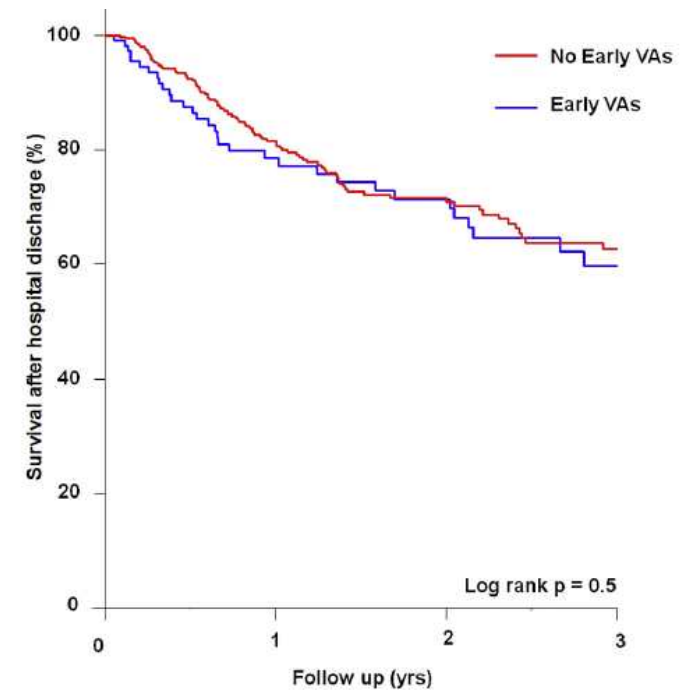
VT influence after LVAD

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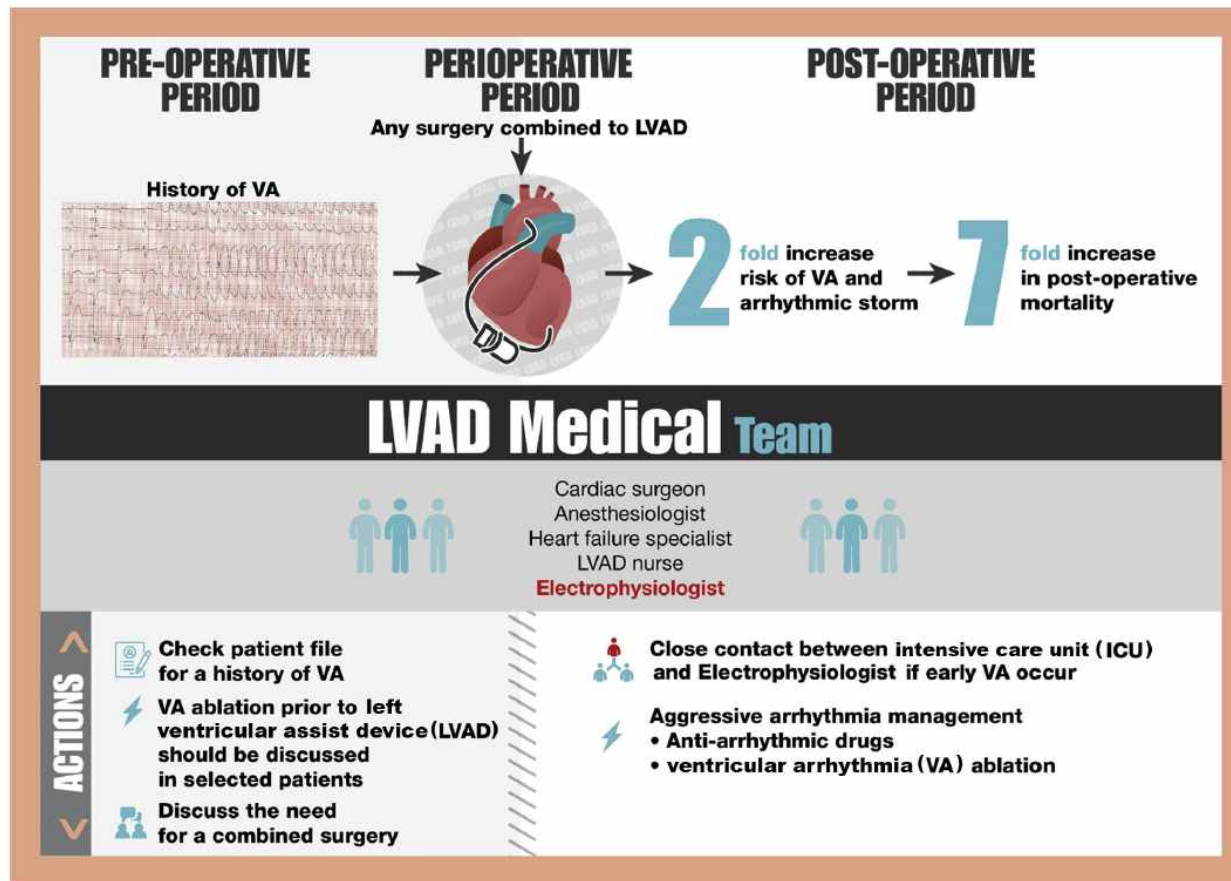


Number at risk

Early VAs	111	59	44	22
No early VA	396	204	105	53

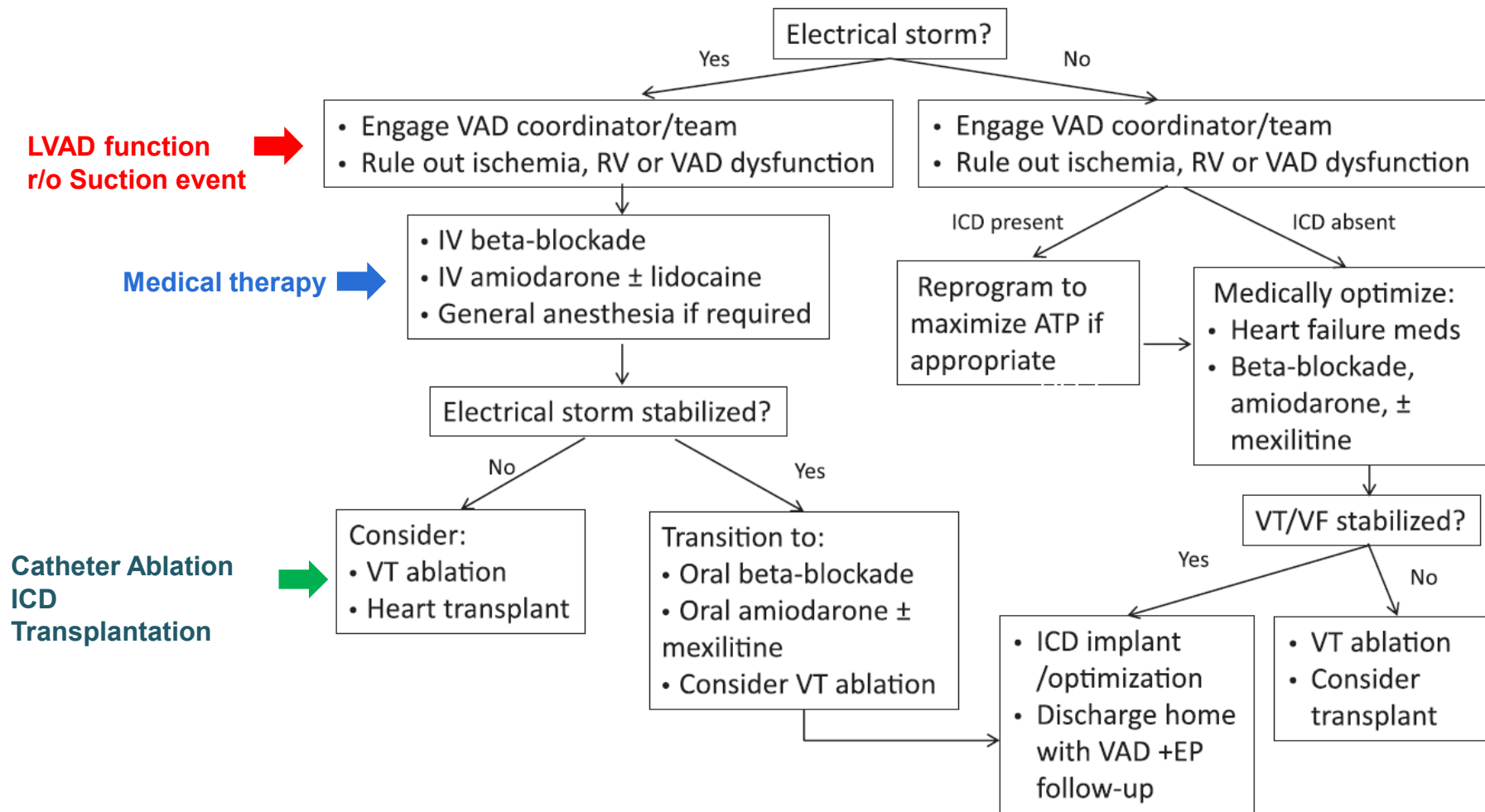
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VT influence after LVAD



Galand et al " Early ventricular Arrhythmia after LVAD implantation is the strongest predictor of 30-day postoperative mortality " JACC EP 2019;5:944-54 9

VT management after LAVD



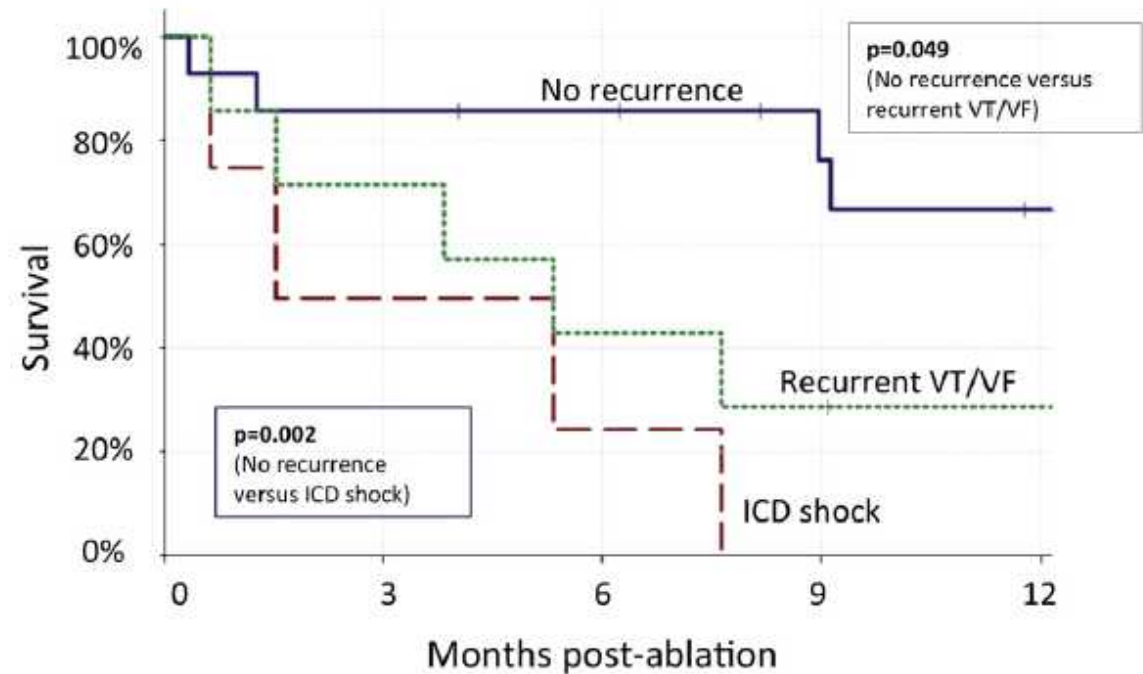
Ventricular Tachycardia with VAD (catheter ablation)

Characterization of Ventricular Tachycardia After Left Ventricular Assist Device Implantation as Destination Therapy

A Single-Center Ablation Experience

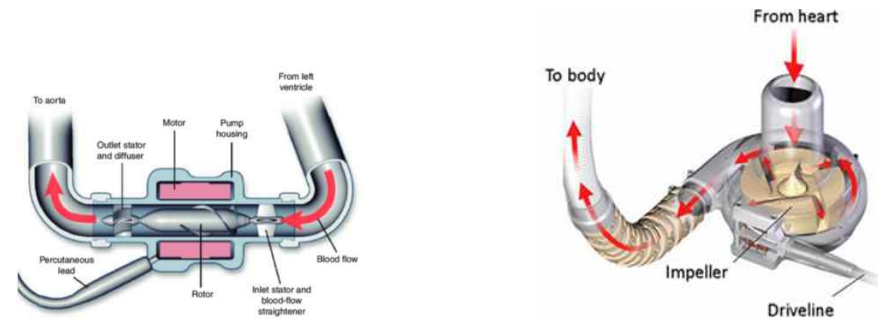
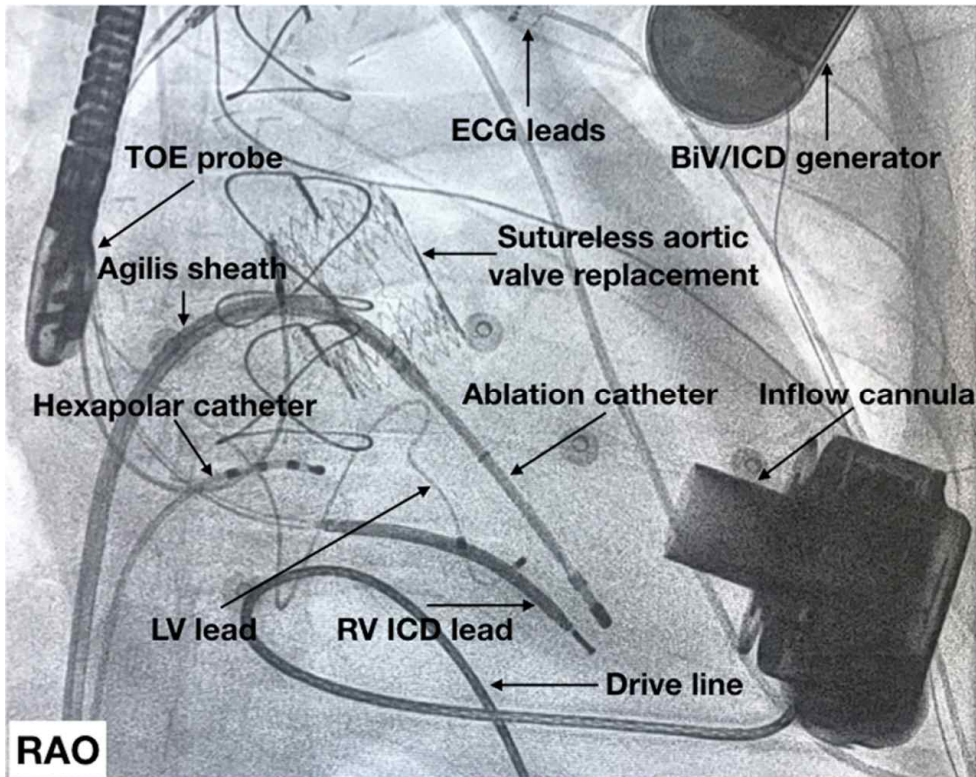
Joshua D. Moss, MD,^a Erin E. Flatley, RN, MSN, ANP-BC,^b Andrew D. Beaser, MD,^b John H. Shin, MD,^c Hemal M. Nayak, MD,^b Gaurav A. Upadhyay, MD,^b Martin C. Burke, DO,^d Valluvan Jeevanandam, MD,^b Nir Uriel, MD,^b Roderick Tung, MD^b

- **Single center between 2010 and 2016**
- **21 patients (15 Heart mate II/ 6 HeartWare)**
- **191 days after LVAD implantation**
- **No VR recurrence : 12 patients (57%)**
- **4 LAVD thrombosis**



Moss et al "Characterization of VT after VAD as destination therapy JACC EP 2017;3:1412-24

Ventricular Tachycardia with VAD (Catheter ablation)



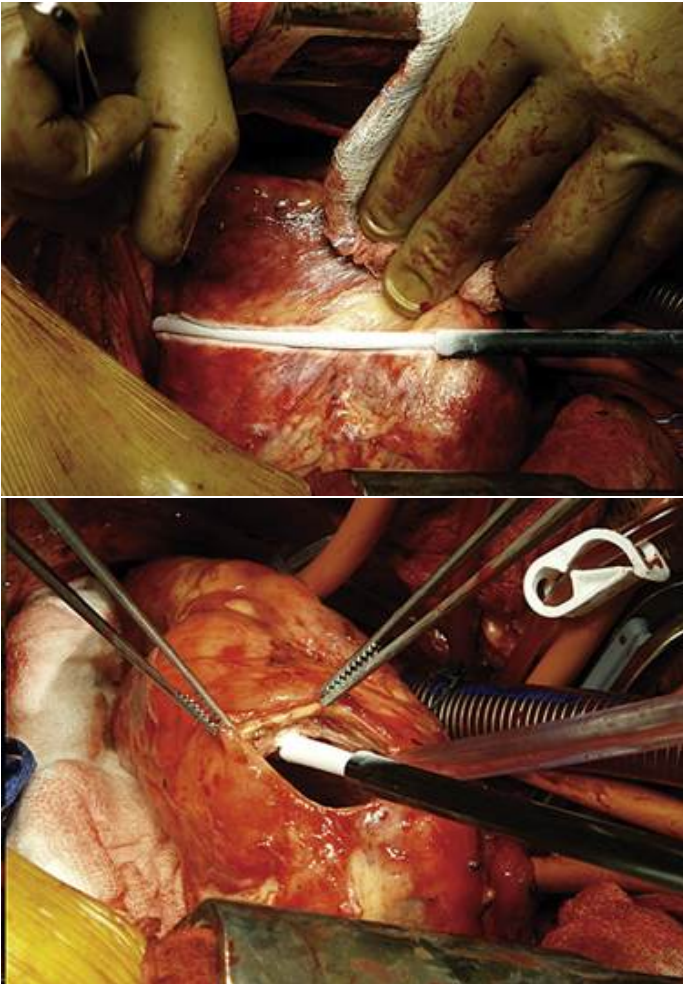
Heart Mate II
(D:25mm/ L:20mm)



Heart Ware
(D:21mm/ L : 25mm)

Process barrier to catheter ablation after LVAD !!

Ventricular Tachycardia with VAD (Surgical ablation)



Cryoablation during left ventricular assist device implantation reduces postoperative ventricular tachyarrhythmias

Daniel P. Mulloy, MD^a, Castigliano M. Bhamidipati, DO, MSc^a, Matthew L. Stone, MD^a, Gorav Ailawadi, MD^a, James D. Bergin, MD^b, Srijoy Mahapatra, MD^b, and John A. Kern, MD^a

^a Department of Surgery, and the Division of Cardiovascular Medicine, Division of Thoracic and Cardiovascular Surgery

^b Department of Medicine, University of Virginia Health System, Charlottesville, Va.

- 50 HeartMate II LVAD
- 14 patients had recurrent preoperative VA.
- Half (7 patients) underwent intraoperative cryoablation.
- No recurrent VA and ablation shock at cryoablation group.

No follow-up data to demonstrate clinical benefit !!

Mulloy etl al. "Cryoablation during left ventricular assist device implantation reduces postoperative ventricular tachyarrhythmias" *J Thorac Cardiovasc Surg.* 2013 May;145(5) 13

Ventricular Tachycardia with VAD (Surgical ablation)

CASE REPORT

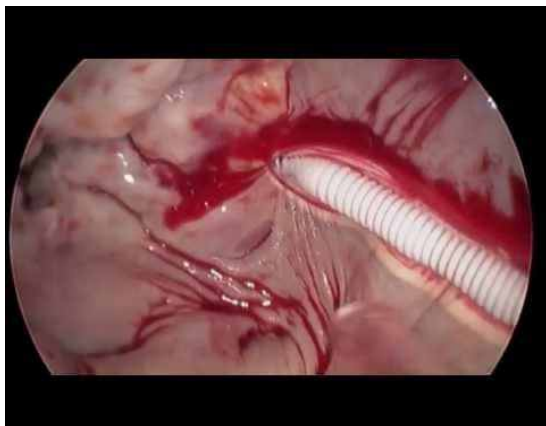
Open Access



Concomitant surgical cryoablation for refractory ventricular tachycardia and left ventricular assist device placement: a dual remedy but a recipe for thrombosis?

Colleen K. McIlvennan^{1*}, Ashok N. Babu², Andreas Briek¹ and Amrut V. Ambardekar¹

- **Thrombogenic state**
- **LV endocardial inflammation reaction**
- **Low-blood flow in LV cavity**



	Patient #1	Patient #2
BASELINE		
Age	70	64
Gender	Female	Male
Etiology of Heart Failure	Non-Ischemic	Ischemic
VT Characteristics	Monomorphic at >188 bpm	Monomorphic at 135 bpm
Type of Surgical Ablation	Epicardial Endocardial	Epicardial Endocardial
LVAD	HeartMate II	HeartMate II
LVAD Indication	Destination Therapy	Bridge to Transplant
POST-LVAD		
Antiarrhythmic	Amiodarone	Amiodarone Mexiletine
Anticoagulation INR 2.0~3.0	Heparin Warfarin ^a	Heparin Warfarin ^a
Aspirin	81 mg	81 mg
Peak LDH ^b	2086 U/L	1368 U/L
Further VT	No	No
Thrombus Confirmed from Explanted LVAD	Yes	Yes

McIlvennan et al. *J Cardiothoracic Surgery* (2016) 11:53

Ventricular Tachycardia with VAD (Surgical ablation)

- **Stable hemodynamics and minimal symptom even though VT**
- **High risk of LVAD mechanical failure because thrombogenic event**
- **Difficult to determine trigger site in LV cavity**

Only 1 paper and 2 case reports

The screenshot shows a PubMed search results page. The search query is "Surgical cryoablation during ventricular assist device". The results are sorted by "Most Recent" and show 6 items, with 3 selected. The selected items are:

- [Concomitant surgical cryoablation for refractory ventricular tachycardia and left ventricular assist device placement: a dual remedy but a recipe for thrombosis?](#) McIlvennan CK et al. J Cardiothorac Surg. (2016)
- [Management of pediatric tachyarrhythmias on mechanical support.](#) Silva JN, Erickson CC, Carter CD, Greene EA, Kantoch M, Collins KK, Miyake CY, Carboni MP, Rhee EK, Papez A, Anand V, Bowman TM, Van Hare GF; Participating Members of Pediatric and Congenital Electrophysiology Society (PACES). Circ Arrhythm Electrophysiol. 2014 Aug;7(4):658-63. doi: 10.1161/CIRCEP.113.000973. Epub 2014 Jul 1. PMID: 24987047 [Similar articles](#)
- [Cryoablation during left ventricular assist device implantation reduces postoperative ventricular tachyarrhythmias.](#) Mulloy DP, Bhamidipati CM, Stone ML, Ailawadi G, Bergin JD, Mahapatra S, Kern JA. J Thorac Cardiovasc Surg. 2013 May;145(5):1207-13. doi: 10.1016/j.jtcvs.2012.03.061. Epub 2012 Apr 20. PMID: 22520722 [Free PMC Article](#) [Similar articles](#)
- [Concomitant left ventricular assist device placement and cryoablation for treatment of ventricular tachyarrhythmias associated with heart failure.](#) Emamina A, Nagji AS, Ailawadi G, Bergin JD, Kern JA. Ann Thorac Surg. 2011 Jul;92(1):334-6. doi: 10.1016/j.athoracsur.2010.12.062. PMID: 21718868 [Similar articles](#)

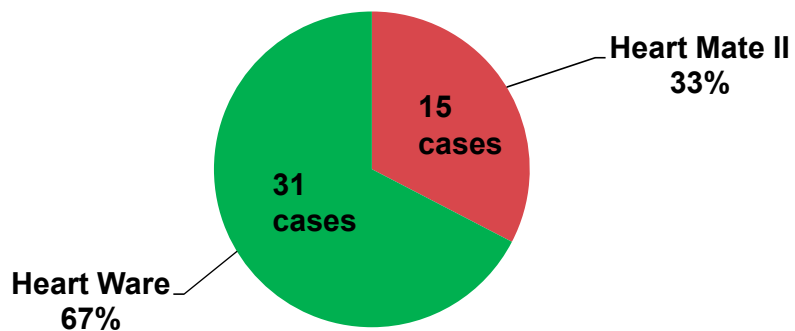
Other results include:

- [Rethinking papillary muscle resection for refractory ventricular tachycardia in the LVAD era. A case report.](#) I'Giovine ZJ, DeVore AD, Patel CB, Koontz J, Schroder J. J Electrocardiol. 2017 Nov - Dec;50(6):964-965. doi: 10.1016/j.jelectrocard.2017.07.007. Epub 2017 Jul 12. PMID: 28802656 [Similar articles](#)

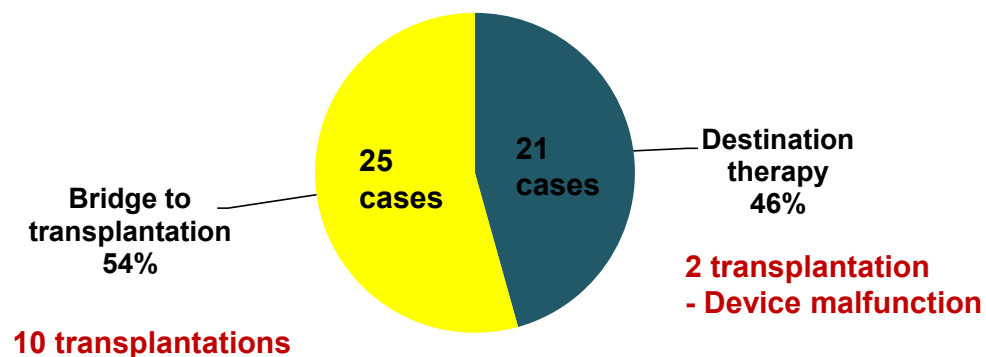
SMC VAD experience

- October 2012~ September 2019
- 46 cases VAD implantation
- Mean Age : 65 years (18~81)
- Frequent ICD shock : **8 patients**
- Ischemic cardiomyopathy : **25 patients**

Type of Device

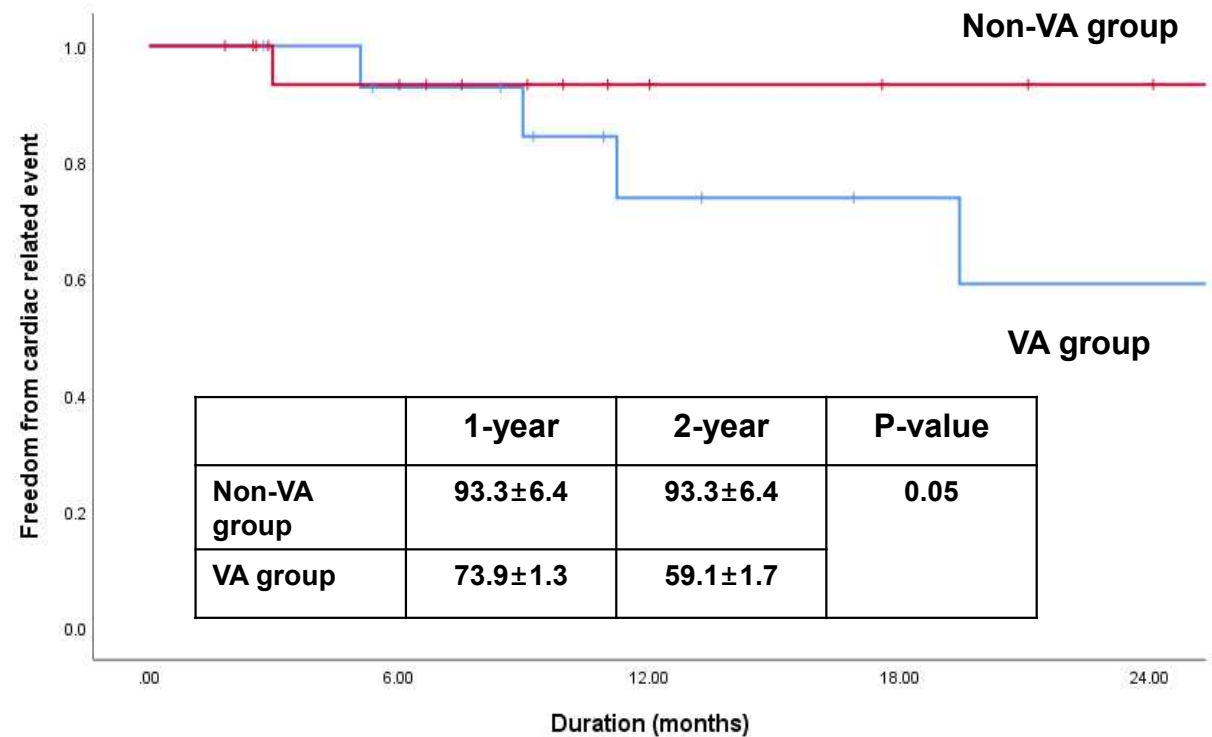
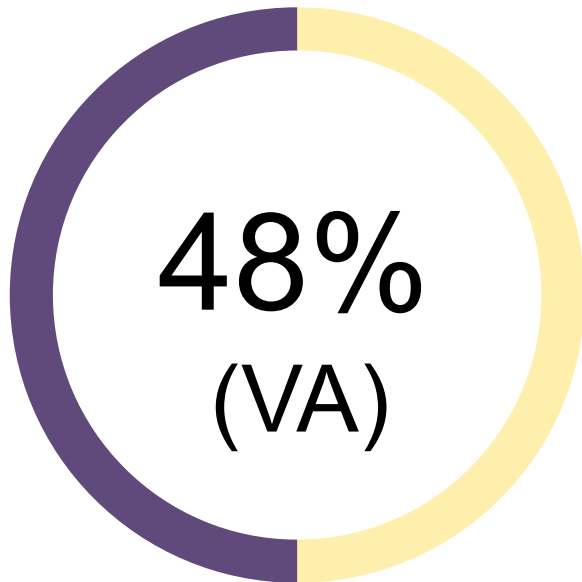


Purpose of Device



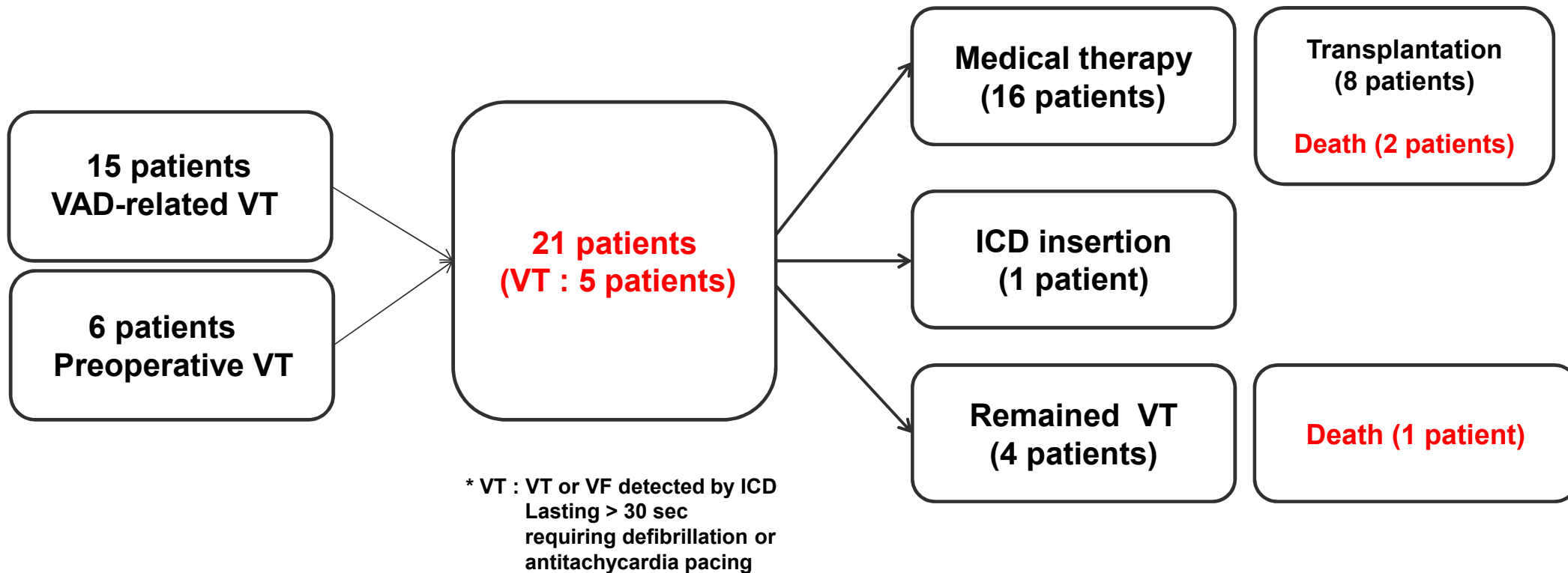
SMC VAD experience

- Postoperative Ventricular arrhythmia : **21 patients (21/46, 48%)**



SMC VAD experience

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Conclusion

- Ventricular Tachycardia is common adverse event after LVAD insertion also is associated with increased morbidity and mortality.
- Catheter ablation is a reasonable treatment strategy. However, surgical ablation during peri-LVAD period is not recommended because high risk of thrombus and uncertainly effectiveness.
- Further research is needed to understand the effects of VT ablation in LVAD patients.

THANK YOU

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