Cardiac implantable device outcomes and lead survival in adult congenital heart disease

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Objective

To assess long-term outcomes of transvenous (TV) and epicardial (EPI) cardiac electronic implantable devices (CIEDs) in adults with congenital heart disease (ACHD)

Background

- Adults with congenital heart disease (ACHD) often require cardiac implantable devices (CIEDs) including pacemakers, defibrillators, and cardiac resynchronization therapy/biventricular devices
- Over 1/3 of ACHD CIEDs are EPI systems
- Long-term outcomes are ill-defined

Methods

- Retrospective review of CIEDs implanted in patients >18 yrs. followed at the Ahmanson/UCLA ACHD Center. Patients were grouped by implant approach (TV, EPI)
- Primary outcomes: time to (1) CIED dysfunction, (2) lead dysfunction and (3) unplanned CIED reintervention
- The Kaplan-Meier method was used to illustrate time to event for the primary outcome variables
- A multivariate Cox proportional hazards model was created to assess for factors associated with time to lead failure

Results

- Over a 27-year period, 283 CIEDs (208 TV, 75 EPI) were implanted in 260 ACHD patients
- The EPI group included more patients with complex congenital heart disease, univentricular morphology, prior Fontan, prior R-sided Maze, unipolar leads, and cyanosis at time of implant
- Dysfunction developed in 77 CIEDs (50 TV, 27 EPI) for which 62 underwent unplanned reintervention (47 TV, 15 EPI)
- Time to CIED dysfunction and unplanned reintervention did not differ by implant approach
- Lead dysfunction was greater for EPI vs TV (HR 2.0, 95% CI 1.2–3.2, p = 0.01)
- Importantly, EPI vs TV approach was not associated with lead dysfunction after adjusting for baseline covariates (HR 0.6, 95% CI 0.6–4.3; p = 0.3)
- Tables and Figures for more information

Figures

Fig. 1. Kaplan-Meier curves depicting the primary study outcomes. Hazard ratios represent comparisons of epicardial vs transvenous CIEDs.

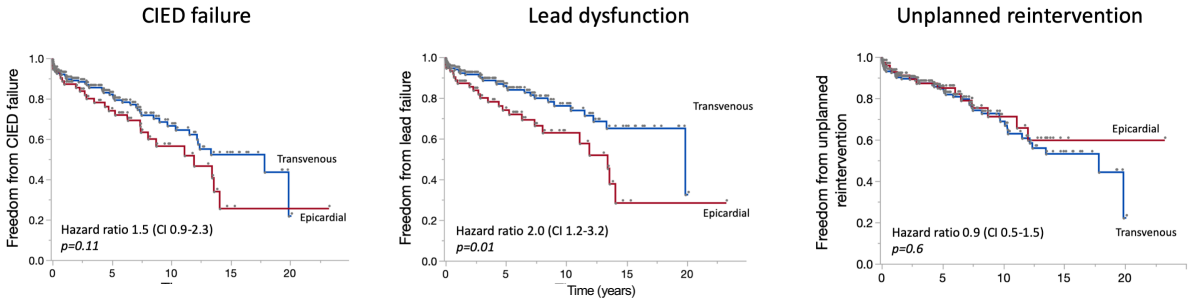


Fig. 2. Multivariate risk factors for lead dysfunction. Approach (EPI vs TV) did not predict lead failure when adjusted for additional model covariates.

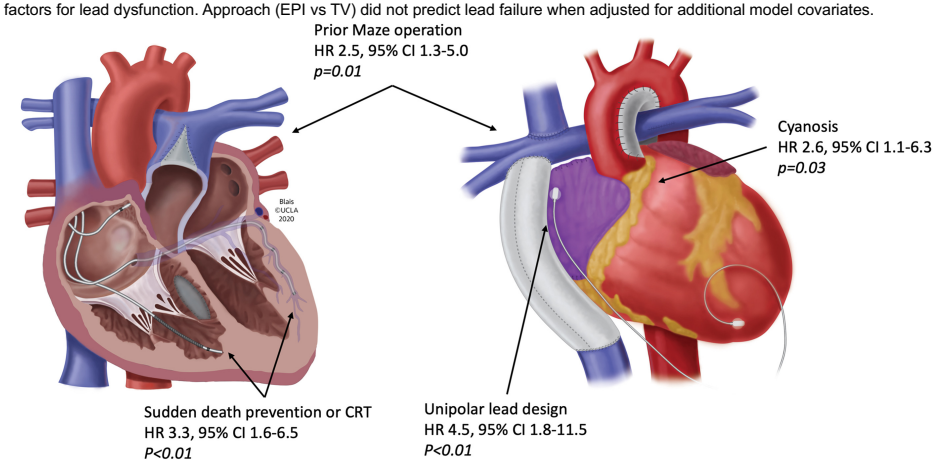
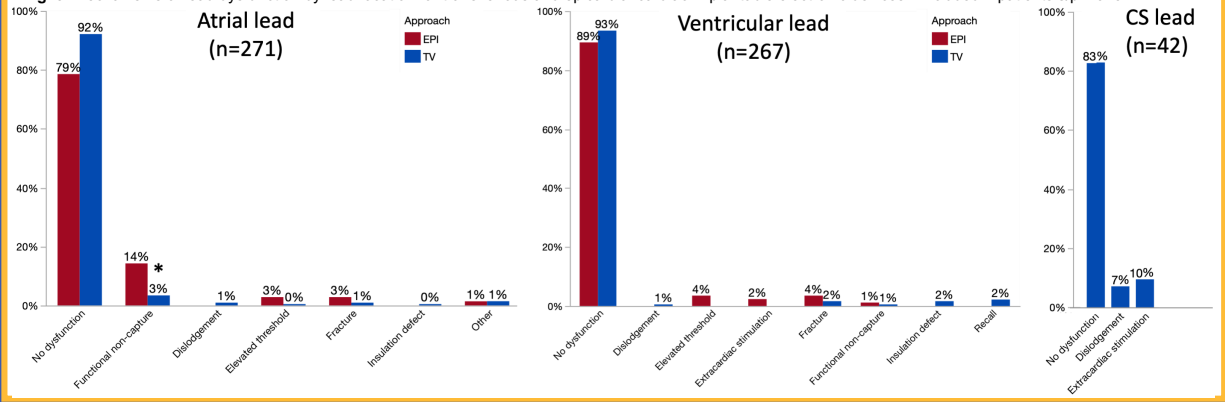


Fig. 3. Mechanisms of lead dysfunction by lead location for transvenous and epicardial cardiac implantable electronic devices. *Included 4 patients s/p Maze.



Table

Table. 1. Mechanism of CIED failure by approach

	TV n=50	EPI n=27
Lead Failure	35 (70%)	25 (92%)
Infection	11 (22%)	1 (4%)
Endocarditis	8	0
Pocket Infection	3	1
Device Migration	2 (4%)	1 (4%)
Other*	2 (4%)	0 (0%)

Discussion

- Overall favorable TV CIED durability (~75% at 10 years) compared to acquired adult heart disease populations
- CIED dysfunction was similar for both TV and EPI approaches and unplanned reinterventions were nearly identical between groups
- Overall lead dysfunction was greater for the EPI approach, driven by an imbalance in baseline patient and device-related factors
- Detailed evaluation of the mechanisms for CIED dysfunction showed that EPI system dysfunctions were more consistently rectified by device reprogramming ($p < 0.001$), whereas TV system dysfunction often required an interventional approach so that reinterventions among the two groups ultimately remained comparable
- Predictors of lead failure in ACHD appear to be unique and potentially modifiable in some cases

Conclusion

- Although lead dysfunction is greater among EPI vs TV devices, there is no difference in time to unplanned re-operation between approaches
- Predictors of lead dysfunction included both patient and device-related factors
- These data suggest relevance for unified surgical practice and novel leadless CIED designs within the growing ACHD populations

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