



Longer Term Results from a Phase I/II
Study of EP-guided Noninvasive Cardiac
Radioablation for Treatment of
Ventricular Tachycardia (ENCORE-VT)

Clifford Robinson, MD

Washington University School of Medicine in St. Louis

Disclosures for Dr. Robinson

- **Employer:** Washington University
- **Stock:** Radialogica
- **Research Grants:** Varian, Elekta, Merck
- **Consulting:** Varian, AstraZeneca, EMD Serono
- **Speaking:** Varian, ViewRay
- Results discussed here involve off-label use of linear accelerators outside of their current 510(k) intended use

Full author list:

C.G. Robinson,¹ P. Samson,¹ K.M.S. Moore,² G.D. Hugo,¹ N. Knutson,¹ S. Mutic,¹ S.M. Goddu,¹ D.H. Cooper,² M. Faddis,² A. Noheria,² T.W. Smith,² P.K. Woodard,³ R.J. Gropler,³ D.E. Hallahan,⁴ Y. Rudy,⁵ and P. Cuculich²

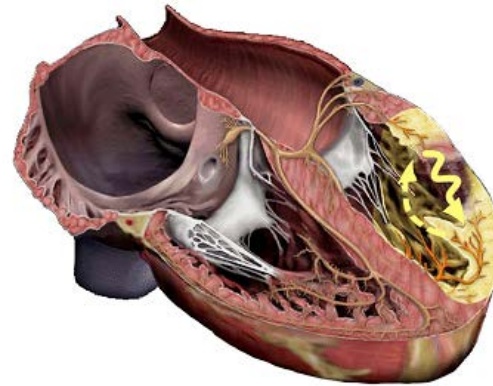
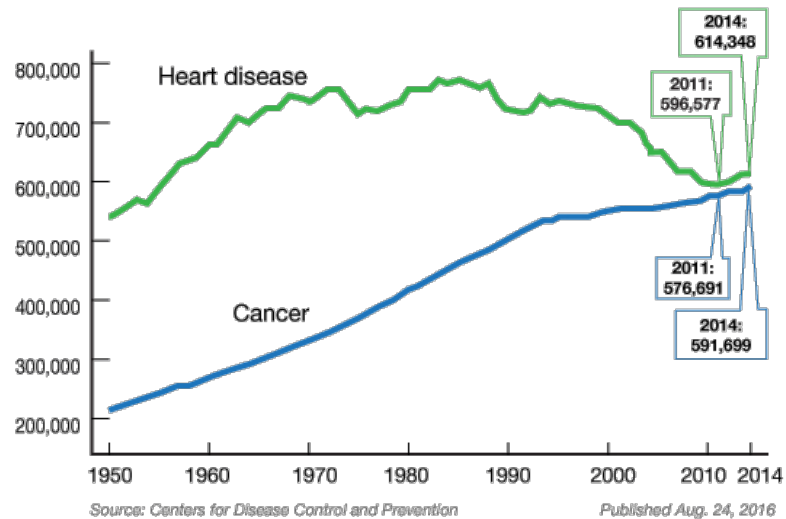
¹ Washington University School of Medicine, Department of Radiation Oncology, St. Louis, MO, ² Washington University School of Medicine, Department of Internal Medicine, Division of Cardiology, St. Louis, MO, ³ Washington University School of Medicine, Department of Radiology, St. Louis, MO, ⁴ Washington University in St. Louis, Department of Radiation Oncology, St. Louis, MO, ⁵ Washington University School of Medicine, Department of Biomedical Engineering, St. Louis, MO

Background

TOP TWO KILLERS

By AMERICAN HEART ASSOCIATION NEWS

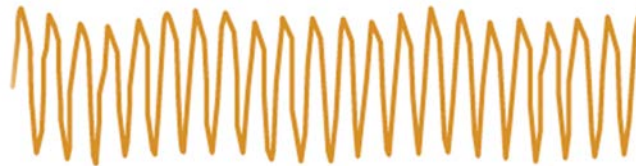
The total number of Americans dying from heart disease rose in recent years following decades in decline. Cancer deaths have nearly tripled since 1950 and continue to climb.



REGULAR HEARTBEAT



VENTRICULAR TACHYCARDIA



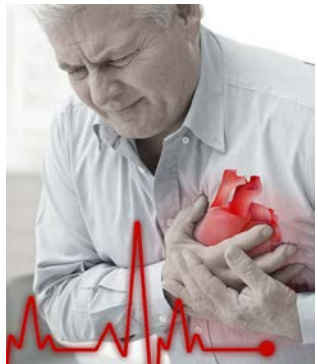
Implantable Cardiac Defibrillator (ICD)



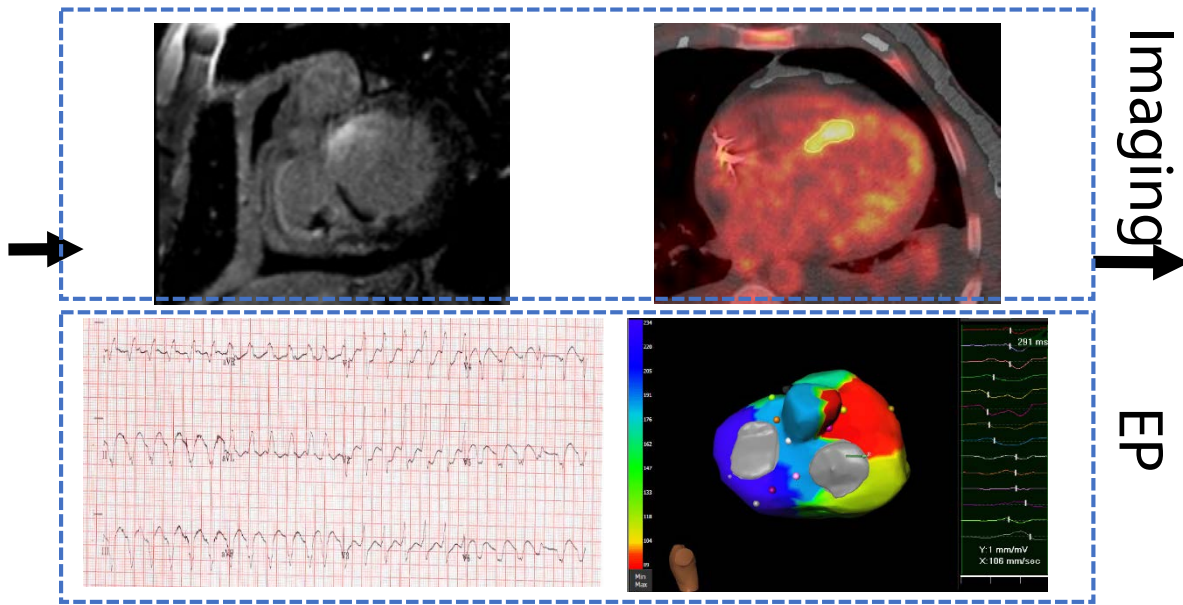
Medications (Amiodarone)



Catheter Ablation

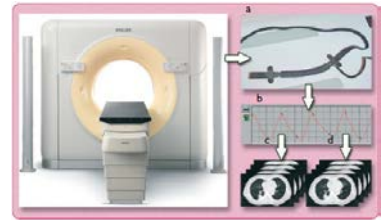


Patient selection



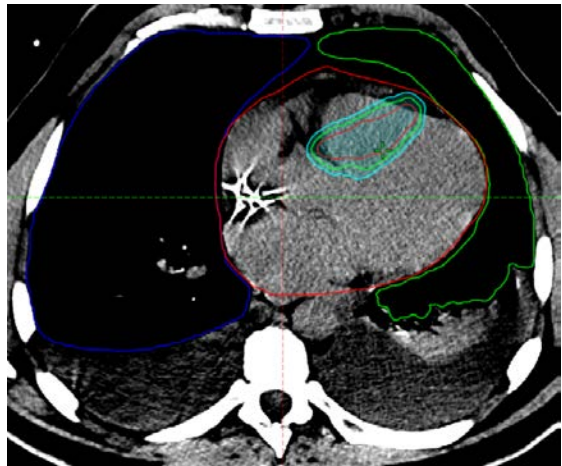
Imaging

EP

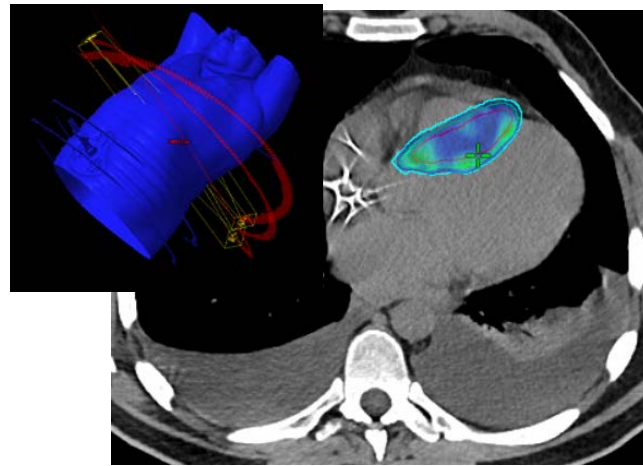


Imaging / Simulation

Workup / Targeting



Segmentation



Treatment Planning



Delivery

Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia

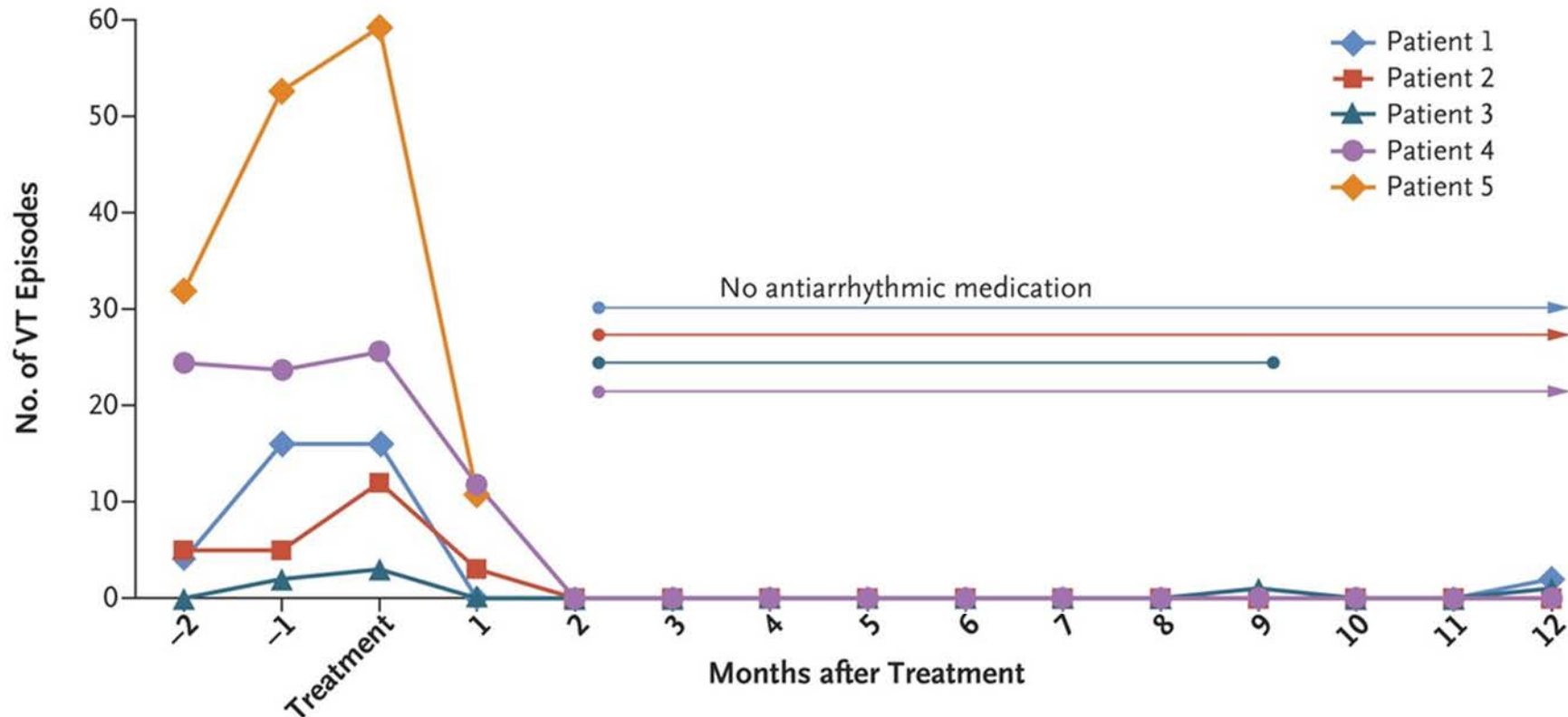
Phillip S. Cuculich, M.D., Matthew R. Schill, M.D., Rojano Kashani, Ph.D., Sasa Mutic, Ph.D., Adam Lang, M.D., Daniel Cooper, M.D., Mitchell Faddis, M.D., Ph.D., Marye Gleva, M.D., Amit Noheria, M.B., B.S., Timothy W. Smith, M.D., D.Phil., Dennis Hallahan, M.D., Yoram Rudy, Ph.D., and Clifford G. Robinson, M.D.

5 patients w/refractory VT treated off-label for clinical need in 2015

Single SBRT treatment, 25 Gy

Average treatment time 14 min

A Monthly Assessment of All VT Episodes per Patient



3 month pre treatment = **6577**

6 week blanking = **680**

Next 10.5 months = **4**

Phase I/II Trial – “ENCORE-VT”

- **Inclusion**
 - ≥ 3 VT episodes over 6 months
 - Failed medication
 - Failed (or too sick for) at least one catheter ablation
- **Phase I - Safety**
 - Serious toxicity in first 90 days
- **Phase II – Efficacy**
 - Any reduction in VT, 6 months before vs after
- **19 patients** - 90% Male and Caucasian
- **Significant cardiac impairment** – Average heart function (EF) less than half of normal
- **High burden of VT** – 53% presented in “storm”
- **Heavily medicated** – 58% on 2+ drugs and >300 mg of amiodarone
- **Average treatment time - 15 min as outpatient**

Phase I – Safety

Serious adverse events, *probably or definitely* related to SBRT

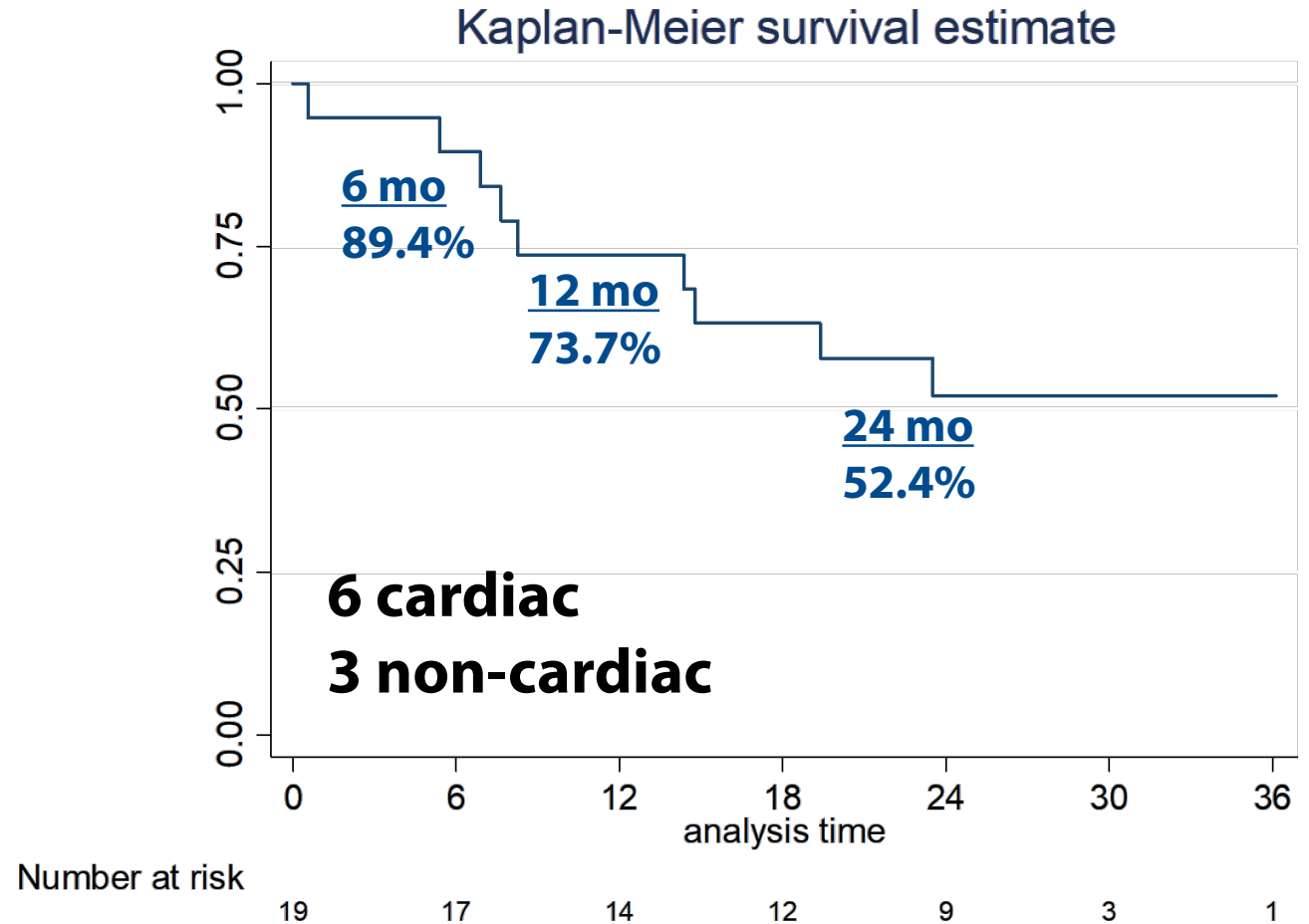
<90 days

- Grade 3
 - **1 pericarditis** (80d)

>90 days

- Grade 3
 - **2 pericardial effusions** (2.2y and 2.4y)
- Grade 4
 - **1 gastropericardial fistula** (2.4y)

**Median follow-up, 23.5 mo
(range, 0.6-36.1)**



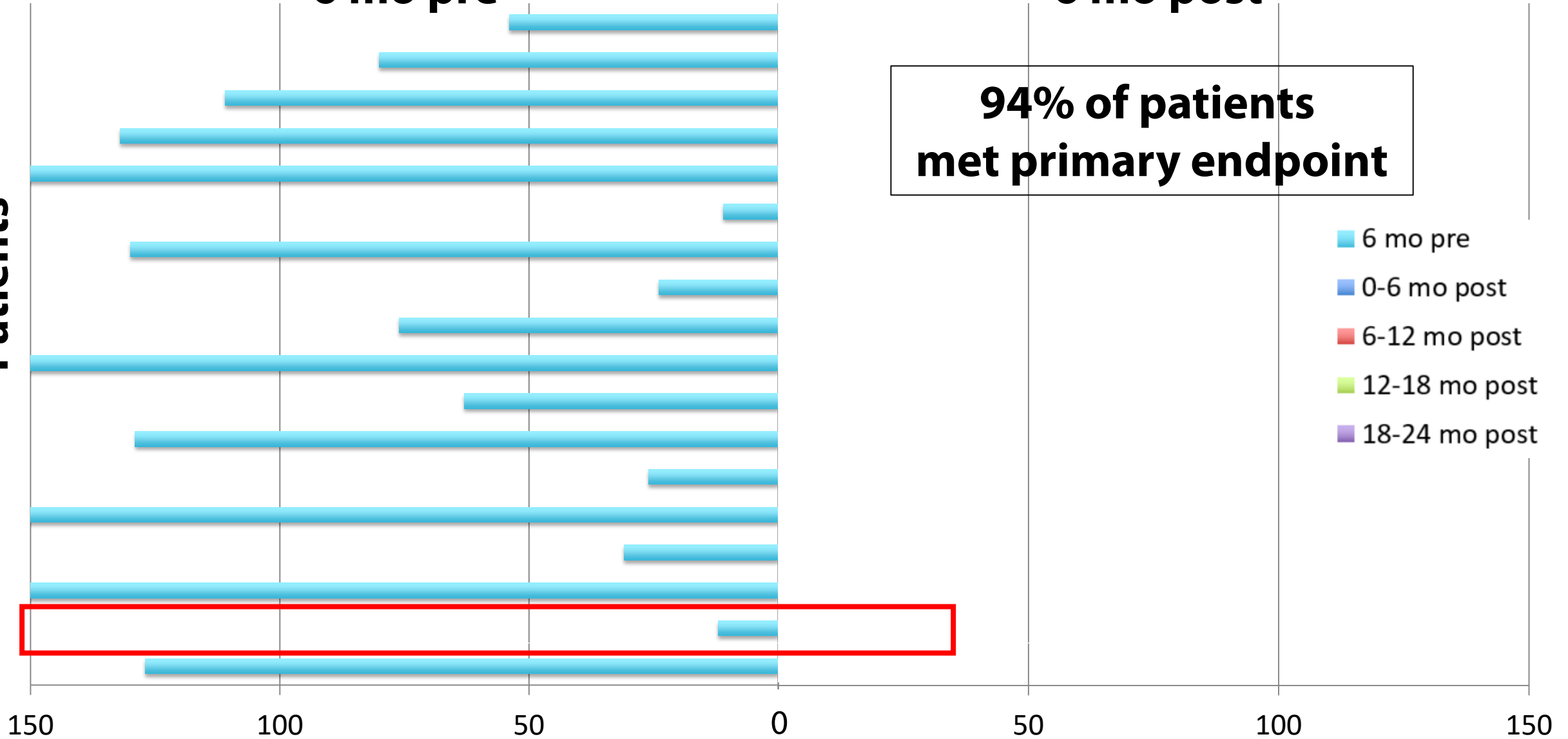
Phase II – Primary Efficacy Endpoint (n=18)

6 mo pre

6 mo post

94% of patients met primary endpoint

Patients



Phase II – Efficacy over time

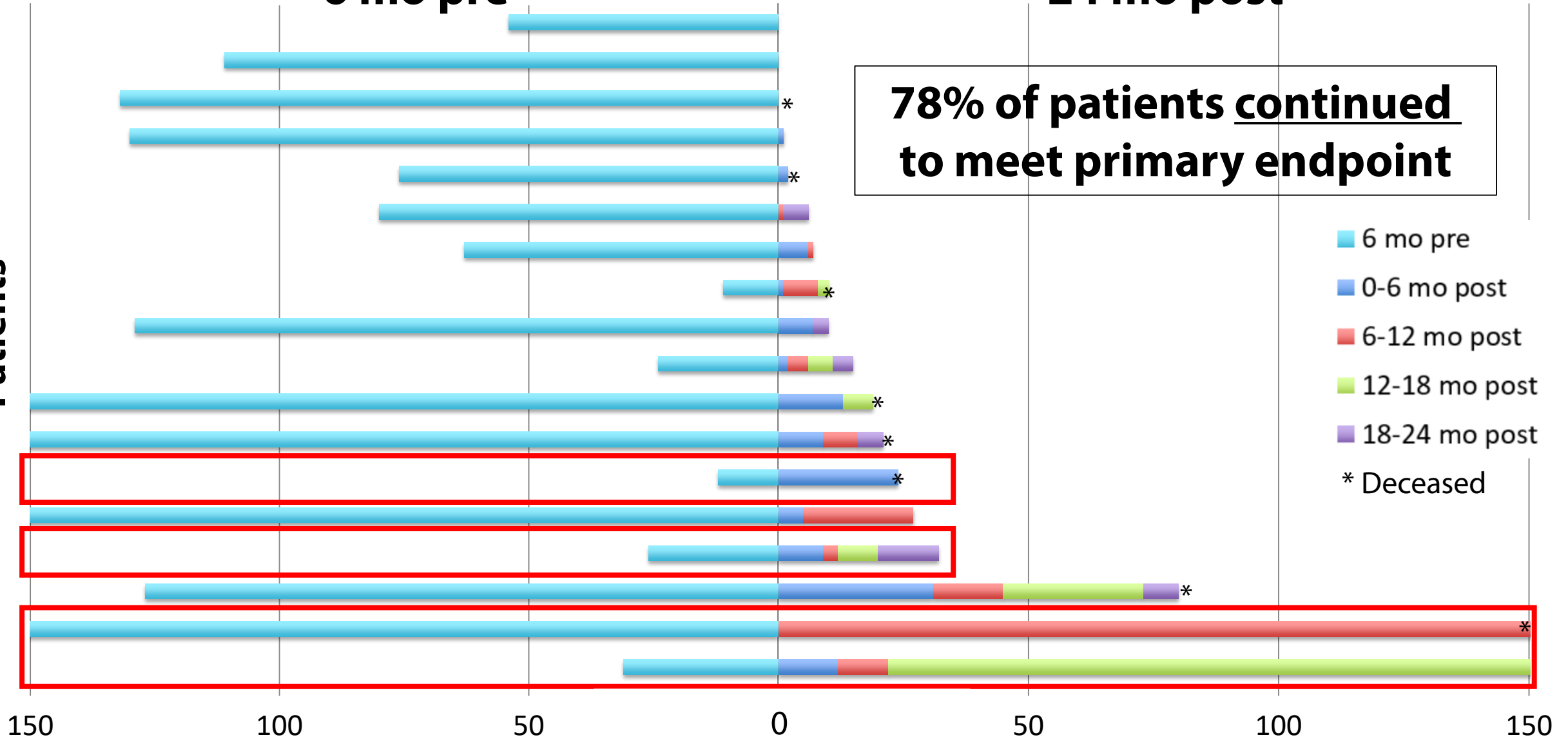
6 mo pre

24 mo post

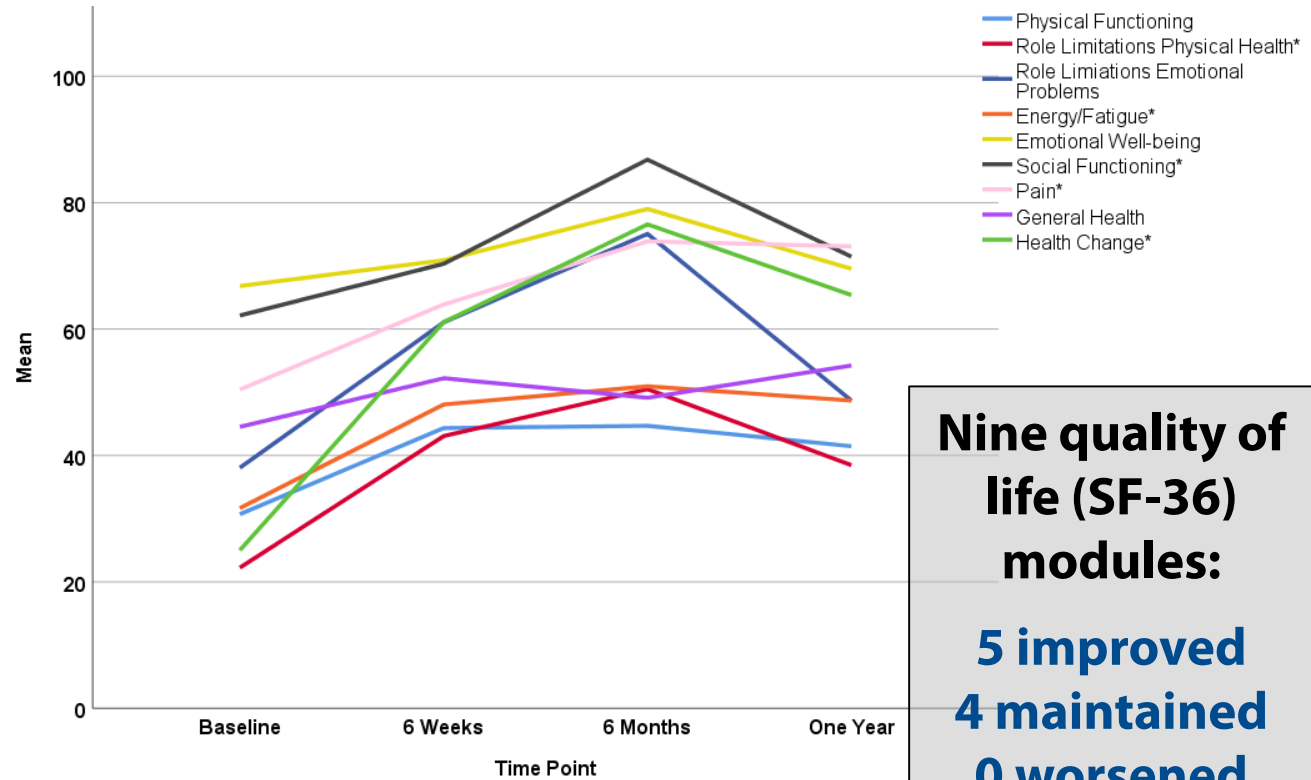
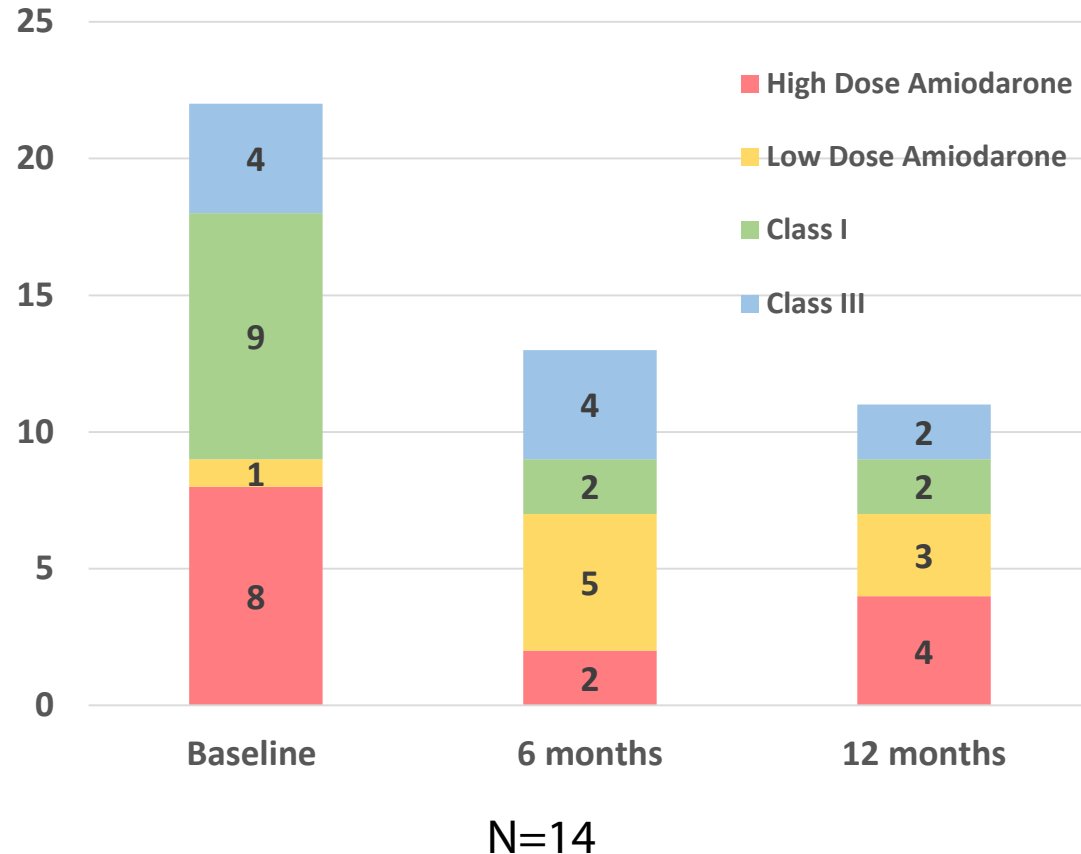
78% of patients continued to meet primary endpoint

Patients

- 6 mo pre
- 0-6 mo post
- 6-12 mo post
- 12-18 mo post
- 18-24 mo post
- * Deceased



Medications and QoL



Nine quality of life (SF-36) modules:

5 improved

4 maintained

0 worsened

Conclusion

We were able to **significantly reduce VT** using a workflow combining **noninvasive** imaging with a single noninvasive radiation therapy treatment

The **effect persisted for 2 years** in most patients

Serious toxicity was low, but may occur after 2 years. Long term follow-up is needed

ENCORE is currently **best suited for high-risk patients** who have failed conventional treatments for VT, and ideally on study