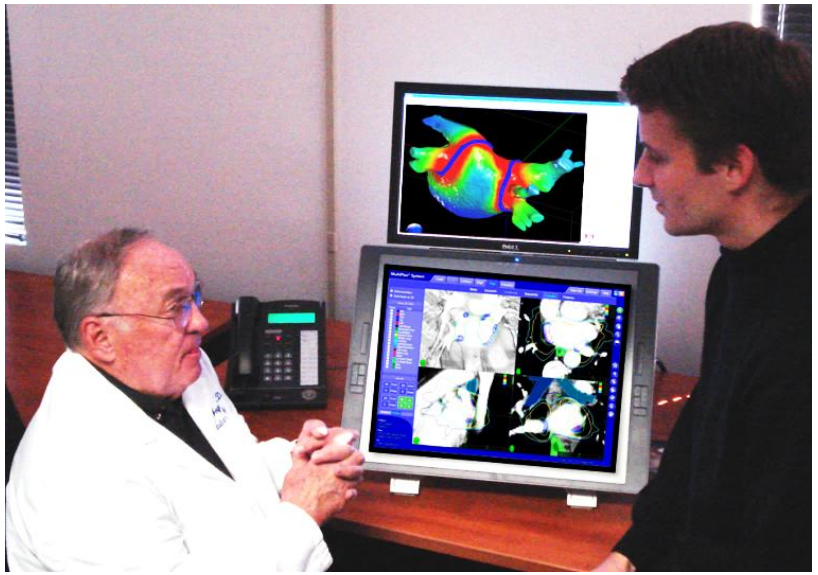
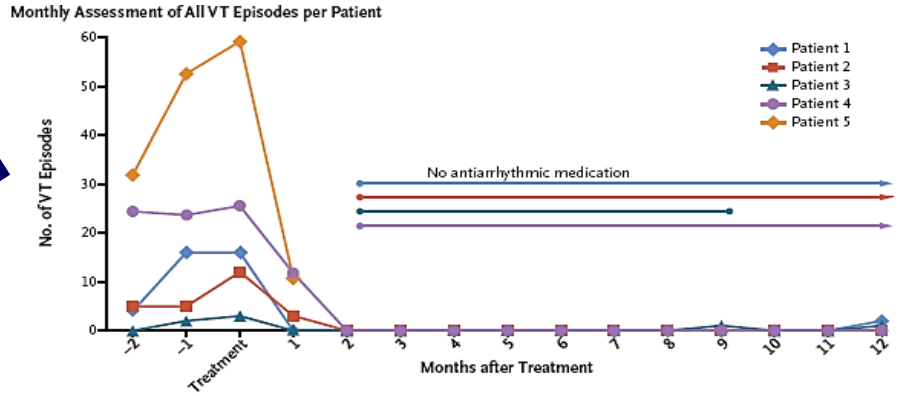


Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia

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.



Strahlentherapie bei Ventrikulären Tachykardien: Wann, wie und für wen?

PD Dr. Oliver Blanck

Koordinator STOPSTORM (EU-H2020 Grant 945119)
UKSH, Campus Kiel, Klinik für Strahlentherapie

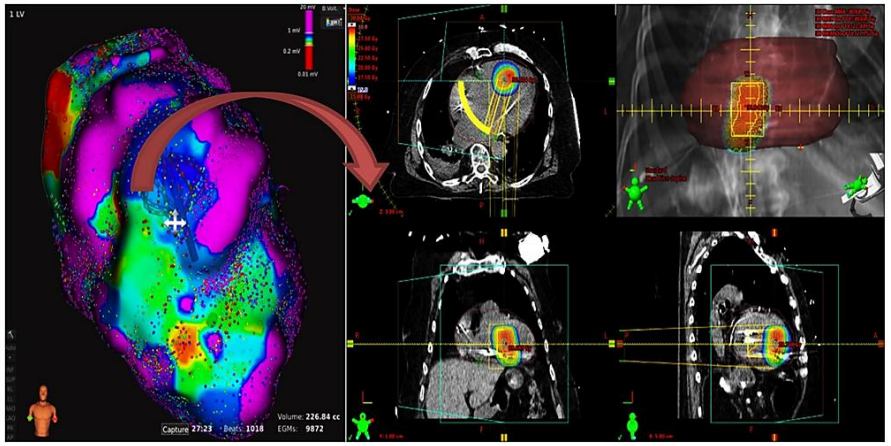
Leiter Operatives Geschäft, Medizinphysik, Forschung und Entwicklung Saphir Radiochirurgie (Frankfurt am Main, Kiel)

Disclosures: None

Stereotactic body radiotherapy for ventricular tachycardia (cardiac radiosurgery)

First-in-patient treatment in Germany

David Krug[1] · Oliver Blanck[1] · Thomas Demming[2] · Matthias Dottermusch[3] · Karoline Koch[4] · Markus Hirt[1] · Laura Kotzott[2] · Adrian Zaman[2] · Lina Eidinger[1,2] · Frank-Andre Siebert[1] · Jürgen Dunst[1] · Hendrik Bonnemeier[2]



Stereotactic Arrhythmia Radioablation (STAR): EHRA/HRS

EHRA/HRS Expert consensus statement and EHRA survey

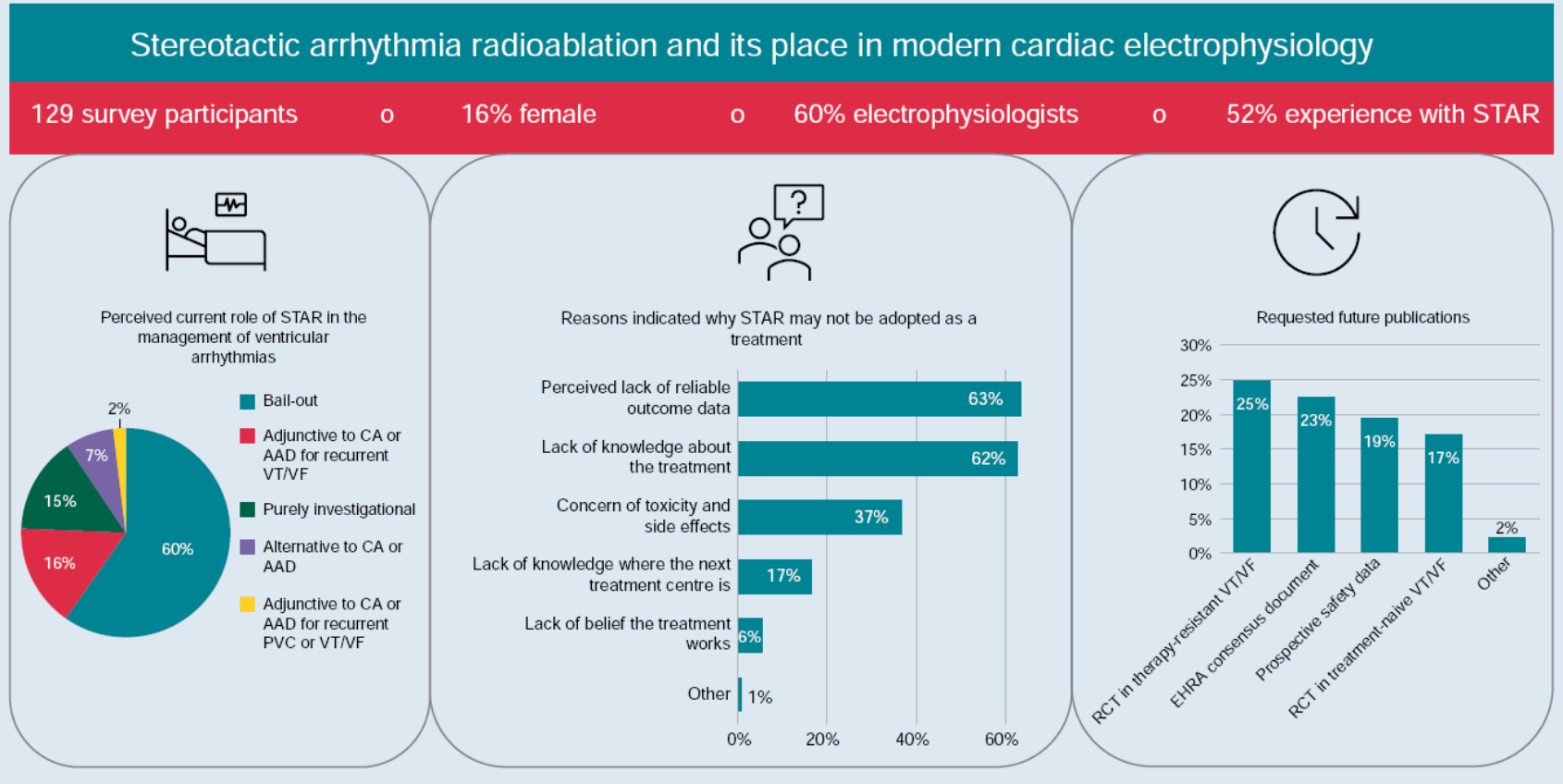
ESC European Society of Cardiology Europace (2024) 27, euae214 https://doi.org/10.1093/europace/euae214 EHRA DOCUMENT EHRA European Heart Rhythm Association

Patient selection, ventricular tachycardia substrate delineation, and data transfer for stereotactic arrhythmia radioablation: a clinical

ESC European Society of Cardiology Europace (2024) 26, euae110 https://doi.org/10.1093/europace/euae110 EHRA SURVEY EHRA European Heart Rhythm Association

Stereotactic arrhythmia radioablation and its implications for modern cardiac electrophysiology: results of an EHRA survey

Boldizsar Kovacs [1,2]*, Helge Immo Lehmann [1,3], Martin Manninger [4], Ardan Muammer Saguner [2], Piotr Futyma [5], David Duncker [6], and Julian Chun [7]



m is heart

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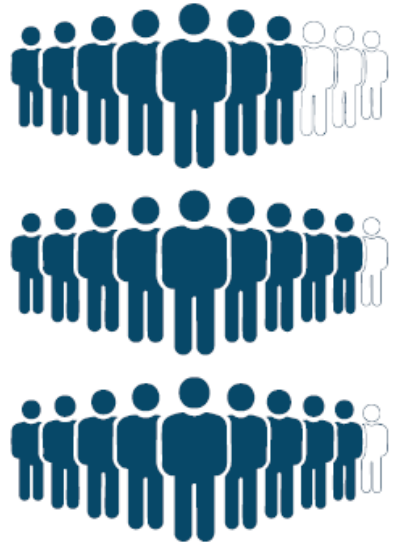
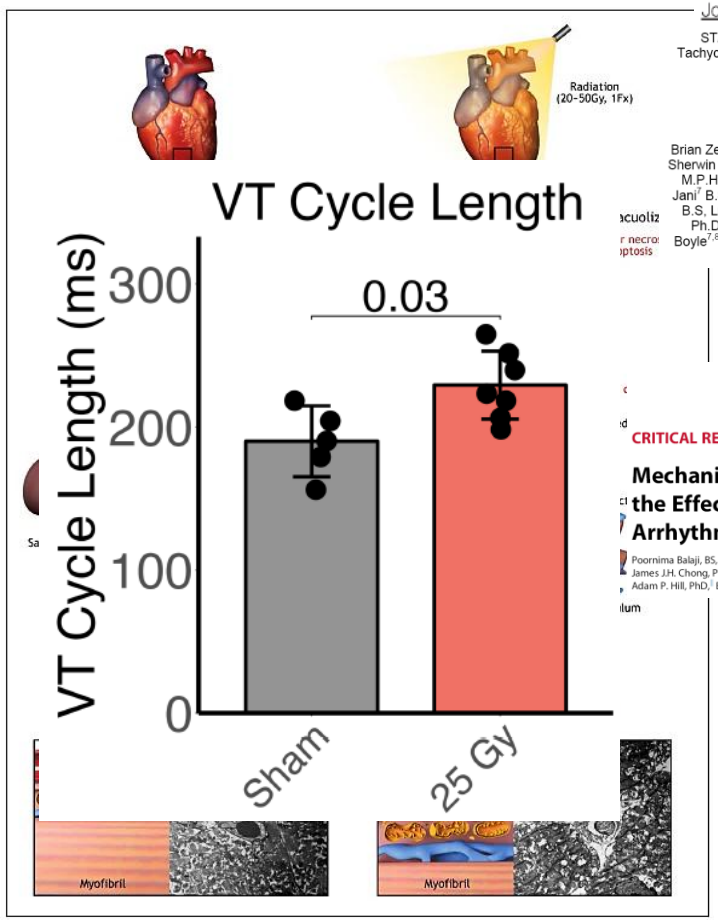
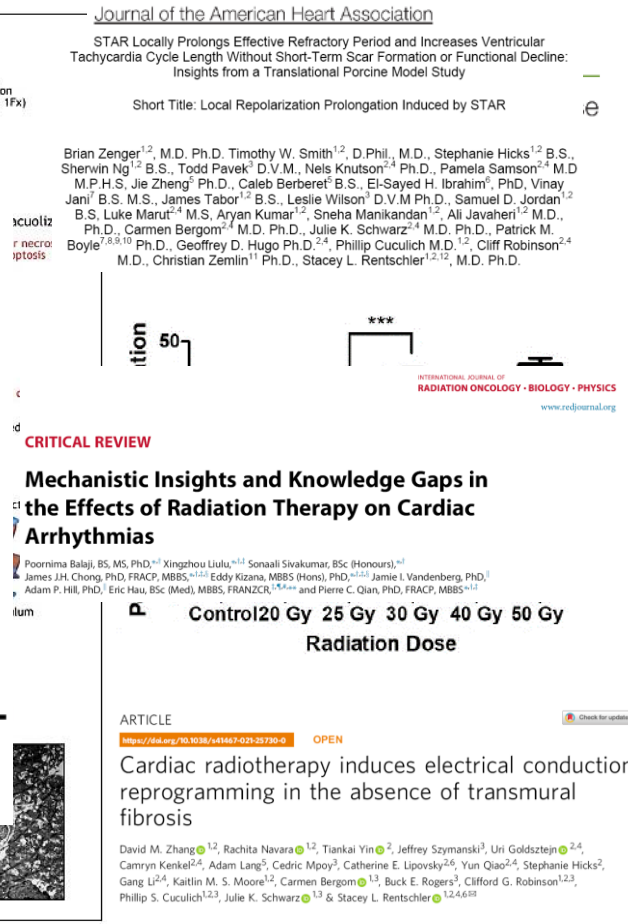


Radiation Biological Effects of High Single Doses in Cardiac Tissue

Doses >30 Gy: Vacuolation and edema, then fibrosis and cell death > 4-6 weeks

Doses 20-25 Gy: Increase in conduction velocity through protein overexpression (Cx43, $Na_v1.5$) and Notch activation without fibrosis




Journal of the American Heart Association

STAR Locally Prolongs Effective Refractory Period and Increases Ventricular Tachycardia Cycle Length Without Short-Term Scar Formation or Functional Decline: Insights from a Translational Porcine Model Study

Short Title: Local Repolarization Prolongation Induced by STAR

Brian Zenger[1,2], M.D. Ph.D. Timothy W. Smith[1,2], D.Phil., M.D., Stephanie Hicks[1,2] B.S., Sherwin Ng[1,2] B.S., Todd Pavek[3] D.V.M., Nels Knutson[2,4] Ph.D., Pamela Samson[2,4] M.D M.P.H.S, Jie Zheng[5] Ph.D., Caleb Berberet[5] B.S., El-Sayed H. Ibrahim[6], PhD, Vinay Jani[7] B.S. M.S., James Tabor[1,2] B.S., Leslie Wilson[3] D.V.M Ph.D., Samuel D. Jordan[1,2] B.S, Luke Marut[2,4] M.S, Aryan Kumar[1,2], Sneha Manikandan[1,2], Ali Javaheri[1,2] M.D., Ph.D., Carmen Bergom[2,4] M.D. Ph.D., Julie K. Schwarz[2,4] M.D. Ph.D., Patrick M. Boyle[7,8,9,10] Ph.D., Geoffrey D. Hugo Ph.D.[2,4], Phillip Cuculich M.D.[1,2], Cliff Robinson[2,4] M.D., Christian Zemlin[11] Ph.D., Stacey L. Rentschler[1,2,12], M.D. Ph.D.

INTERNATIONAL JOURNAL OF RADIATION ONCOLOGY • BIOLOGY • PHYSICS
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CRITICAL REVIEW

Mechanistic Insights and Knowledge Gaps in the Effects of Radiation Therapy on Cardiac Arrhythmias

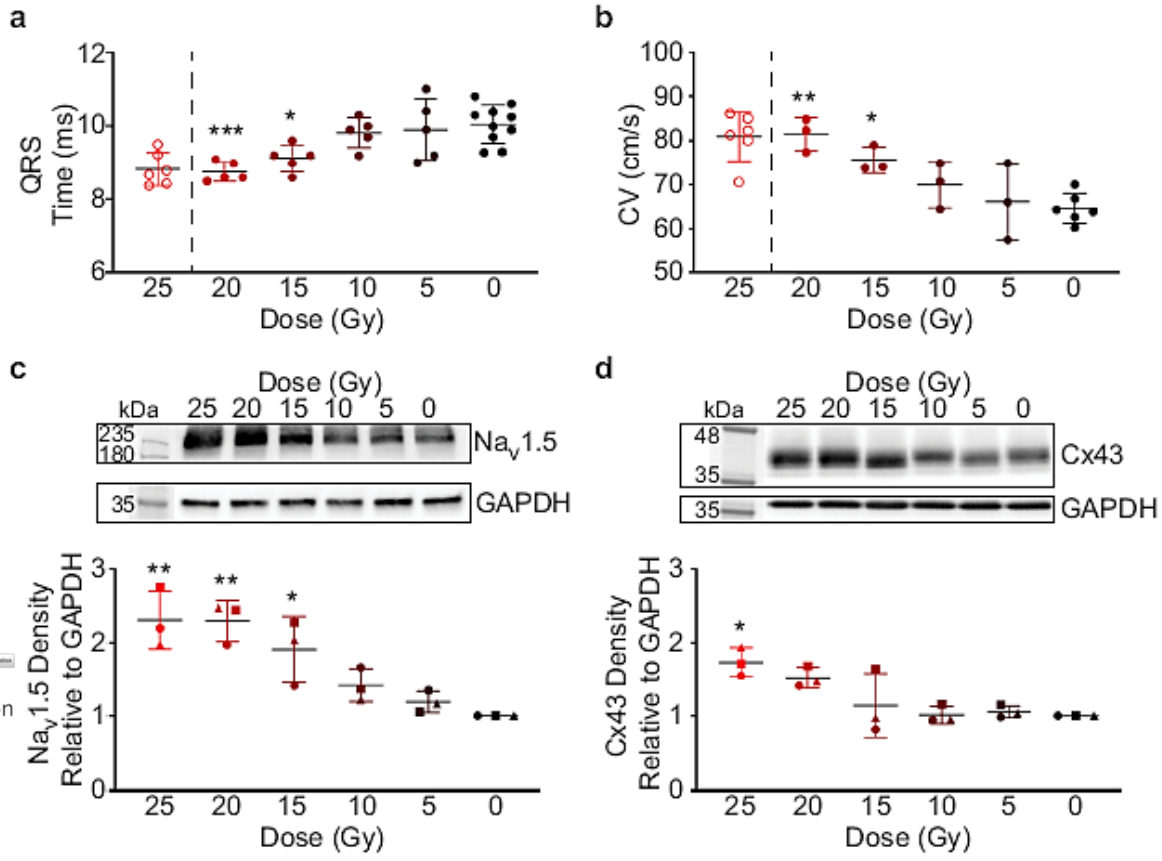
Poornima Balaji, BS, MS, PhD,[*,†] Xingzhou Liulu,[*,‡,§] Sonaali Sivakumar, BSc (Honours),[*,†] James J.H. Chong, PhD, FRACP, MBBS,[*,†,‡,§] Eddy Kizana, MBBS (Hons), PhD,[*,†,‡,§] Jamie I. Vandenberg, PhD,[†] Adam P. Hill, PhD,[†] Eric Hau, BSc (Med), MBBS, FRANZCR,[‖,¶,**] and Pierre C. Qian, PhD, FRACP, MBBS[*,†,‡]

ARTICLE

https://doi.org/10.1038/s41467-021-25730-0 OPEN

Cardiac radiotherapy induces electrical conduction reprogramming in the absence of transmural fibrosis

David M. Zhang[1,2], Rachita Navara[1,2], Tiankai Yin[2], Jeffrey Szymanski[3], Uri Goldsztejn[2,4], Camryn Kenkel[2,4], Adam Lang[5], Cedric Mpoy[3], Catherine E. Lipovsky[2,6], Yun Qiao[2,4], Stephanie Hicks[2], Gang Li[2,4], Kaitlin M. S. Moore[1,2], Carmen Bergom[1,3], Buck E. Rogers[3], Clifford G. Robinson[1,2,3], Phillip S. Cuculich[1,2,3], Julie K. Schwarz[1,3] & Stacey L. Rentschler[1,2,4,6✉]



Target Definition and Transport to Radiation Oncology

Radiotherapy and Oncology 210 (2025) 111004

Contents lists available at ScienceDirect

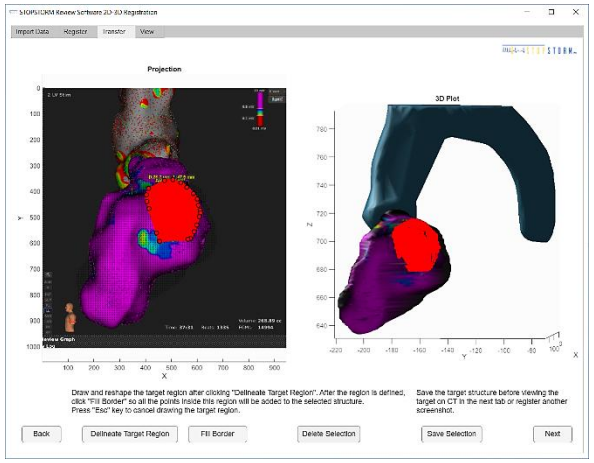
Radiotherapy and Oncology

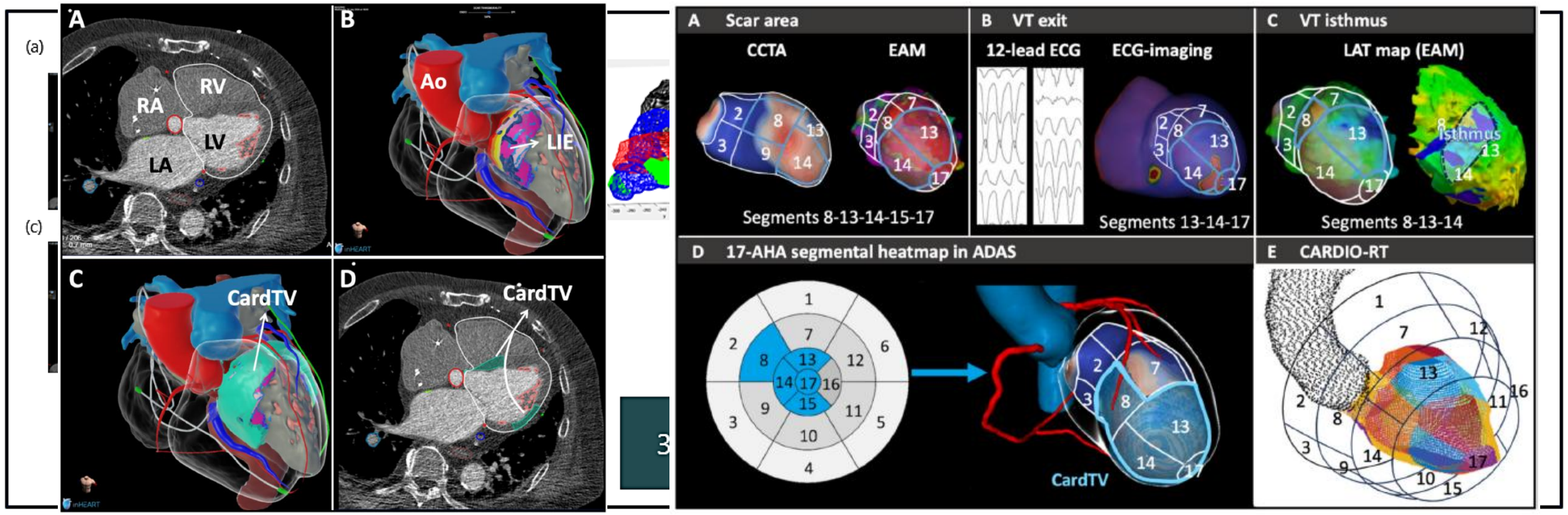
journal homepage: www.thegreenjournal.com

Review Article

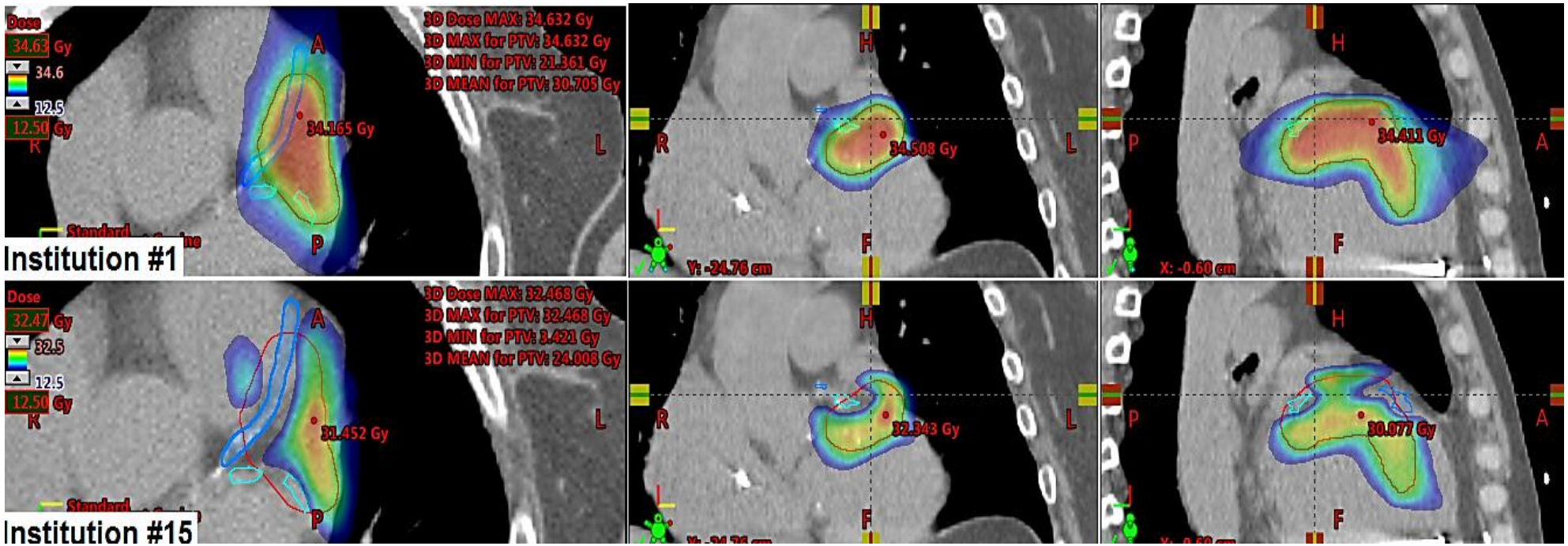
Transfer of arrhythmia substrate targets from the cardiac electroanatomical and imaging modalities to the planning computed tomography scan for stereotactic arrhythmia radioablation for refractory ventricular tachycardia – a state-of-the-art review on software developments on behalf of the STOPSTORM.eu consortium

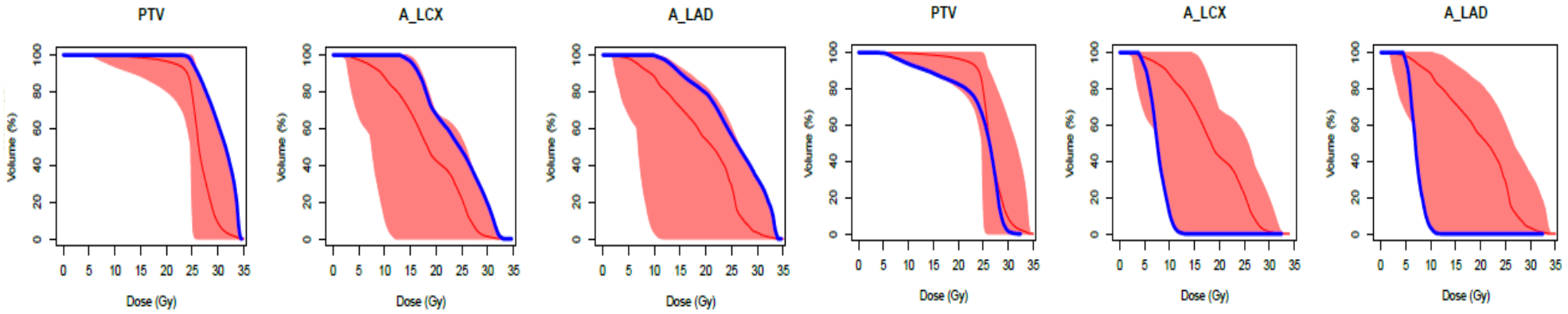
Rachel M.A. ter Bekke [a,*], Stephan Hohmann [b], Jingyang Xie [c], Melanie Grehn [d], Karolien Verhoeven [e], Paul G.A. Volders [a], Casper Mihl [f], Yeşim Selma Kaya [a], Martin Manninger [g], Daniel Scherr [g], Stefanie Corradini [h], Achim Schweikard [c], Robert Rademaker [i], Wiert F. Hoeksema [j,k], Luis Schiappacasse [l], Lukáš Knybel [m], Etienne Pruvot [l], Pieter G. Postema [j,k], Petr Peichl [n], Jakub Cvek [m], Katja Zeppenfeld [i], Oliver Blanck [d,l], Judit Boda-Heggemann [o,p,1]





Radiation Treatment Planning: Target Coverage vs. OAR Sparing





Stereotactic Arrhythmia Radioablation (STAR): Growing Evidence

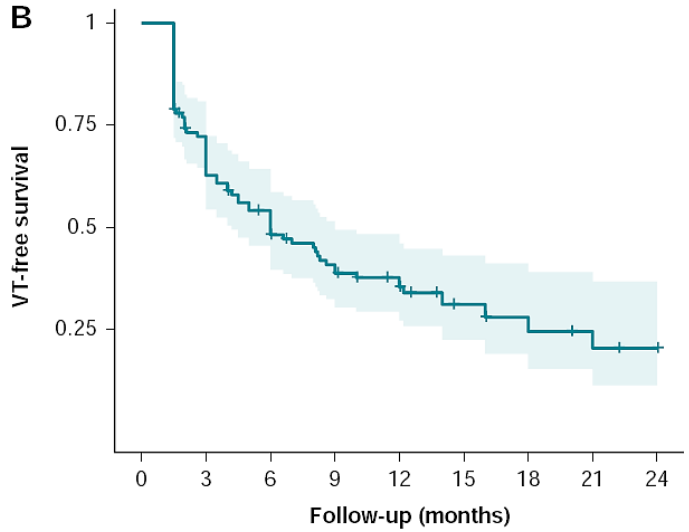
Growing Evidence: Increasing number of clinical studies / meta-analyses are published

ESC European Society of Cardiology
Europace (2025) **27**, euae305
https://doi.org/10.1093/europace/euae305

META-ANALYSIS

Stereotactic cardiac radiotherapy for refractory ventricular tachycardia in structural heart disease patients: a systematic review

Amulya Gupta [1†], Zeeshan Sattar [2†], Nourhan Chaaban[3†], Sagar Ranka [4], Cameron Carlson[5], Farhad Sami [6], Clifford G. Robinson [7], Phillip S. Cuculich [8], Seth H. Sheldon [1], Madhu Reddy[1], David Akhavan [9], and Amit Noheria [1*]

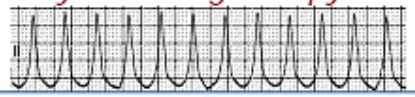


International Journal of Radiation Oncology • Biology • Physics

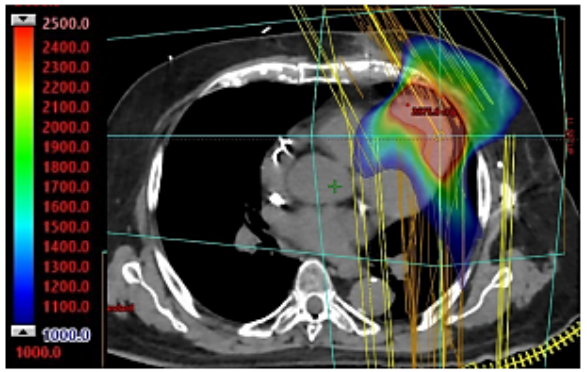
Is Stereotactic Arrhythmia Radiotherapy (STAR) a valid alternative to repeated invasive ablation for refractory ventricular tachycardia?

In regard of: "Stereotactic Arrhythmia Radiotherapy (STAR) vs. Repeat Catheter Ablation for High-Risk Refractory Ventricular Tachycardia: 3-Year Safety and Efficacy Outcomes"

Refractory ventricular tachycardia
Failed antiarrhythmic drug therapy/catheter ablation

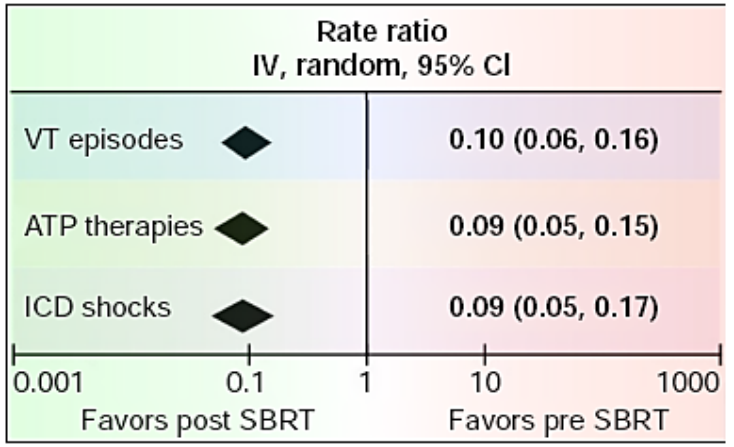


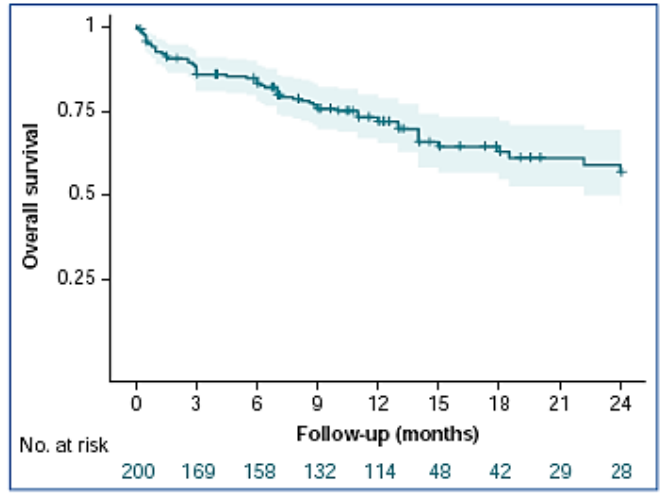
Rescue cardiac SBRT



Pooled analysis of **21 studies** shows **≥90% reduction in VT and ICD therapies** compared to pre-SBRT.

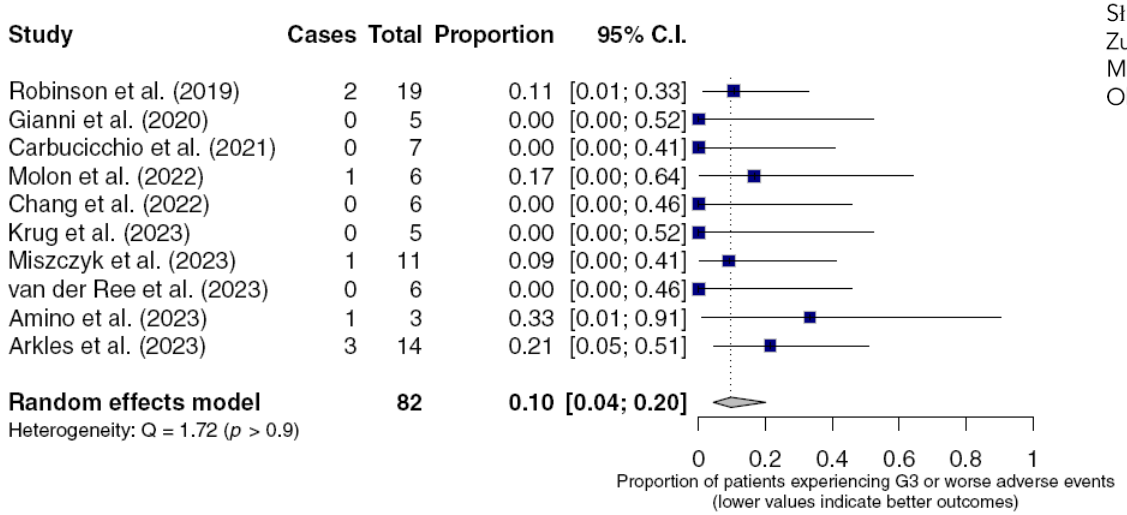
Mortality remained high with **3-, 12-, 24-month survival 86%, 72%** and **57%**, respectively.

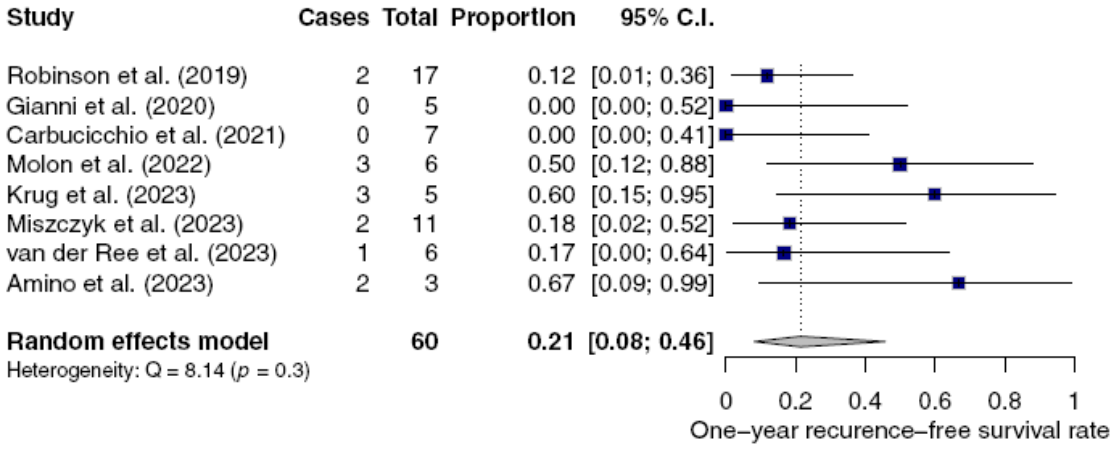




Stereotactic Arrhythmia Radioablation (STAR): Clinical Trials

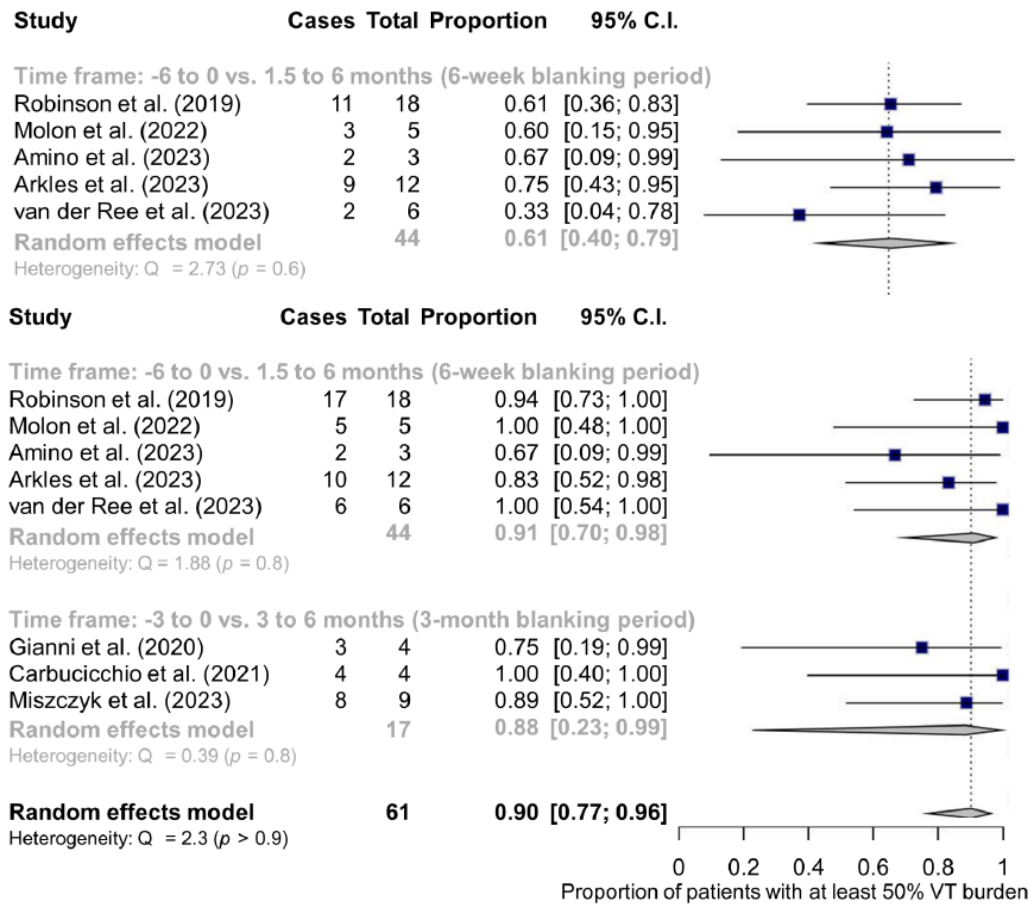
STAR: Highest clinical evidence so far





Stereotactic arrhythmia radioablation (STAR)—A systematic review and meta-analysis of prospective trials on behalf of the STOPSTORM.eu consortium

Marcin Miszczyk, MD, PhD,[1,2,13] Wiert F. Hoeksema, MD,[3,13] Kasper Kuna, MD,[4] Sławomir Blamek, MD, PhD,[5] Phillip S. Cuculich, MD,[6] Melanie Grehn, MS,[7] Giulio Molon, MD,[8] Zuzanna Nowicka, MD,[4] Martijn H. van der Ree, MD,[3] Clifford G. Robinson, MD,[6] Mateusz Sajdok, MD,[9,10,11] Joost J.C. Verhoeff, MD, PhD,[12] Pieter G. Postema, MD, PhD,[3,14] Oliver Blanck, PhD[7,14]

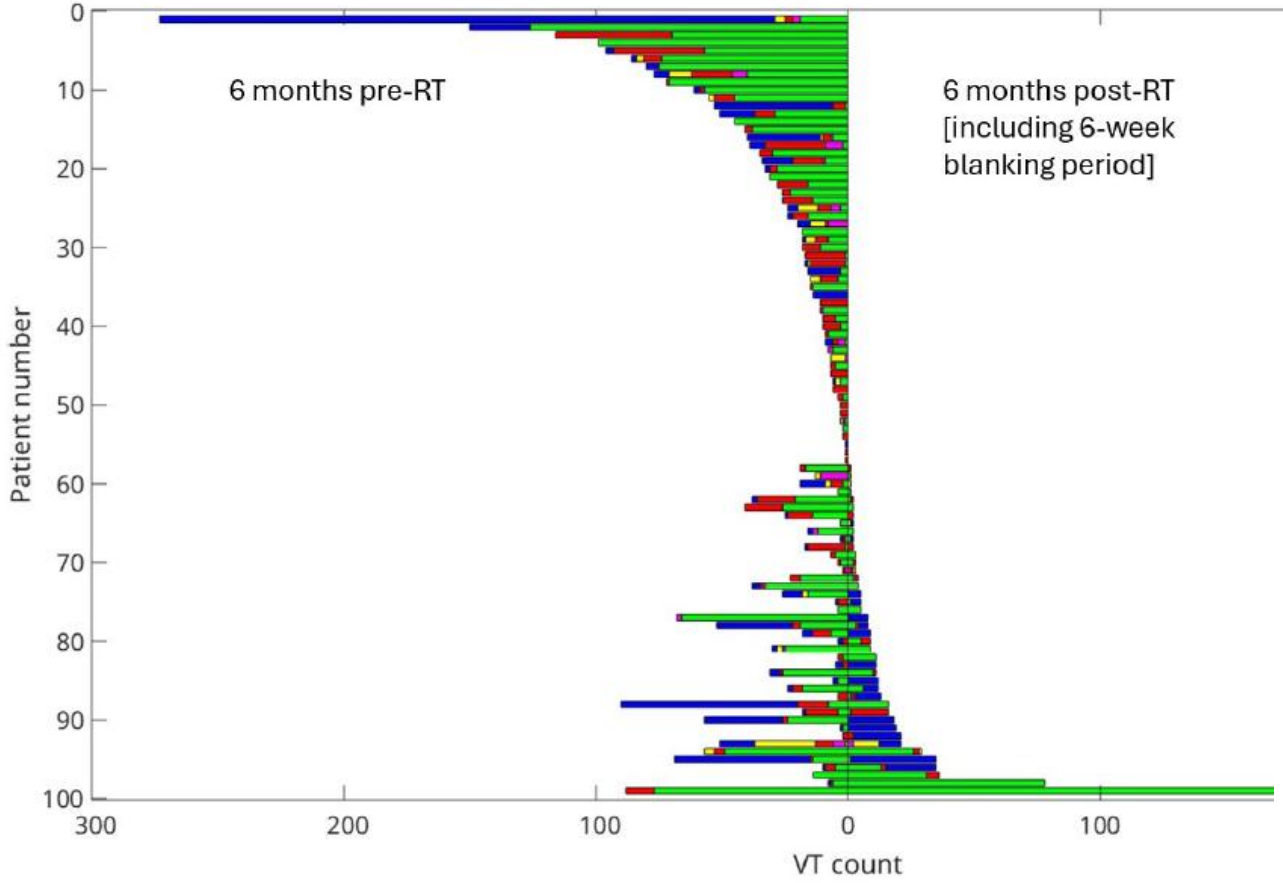


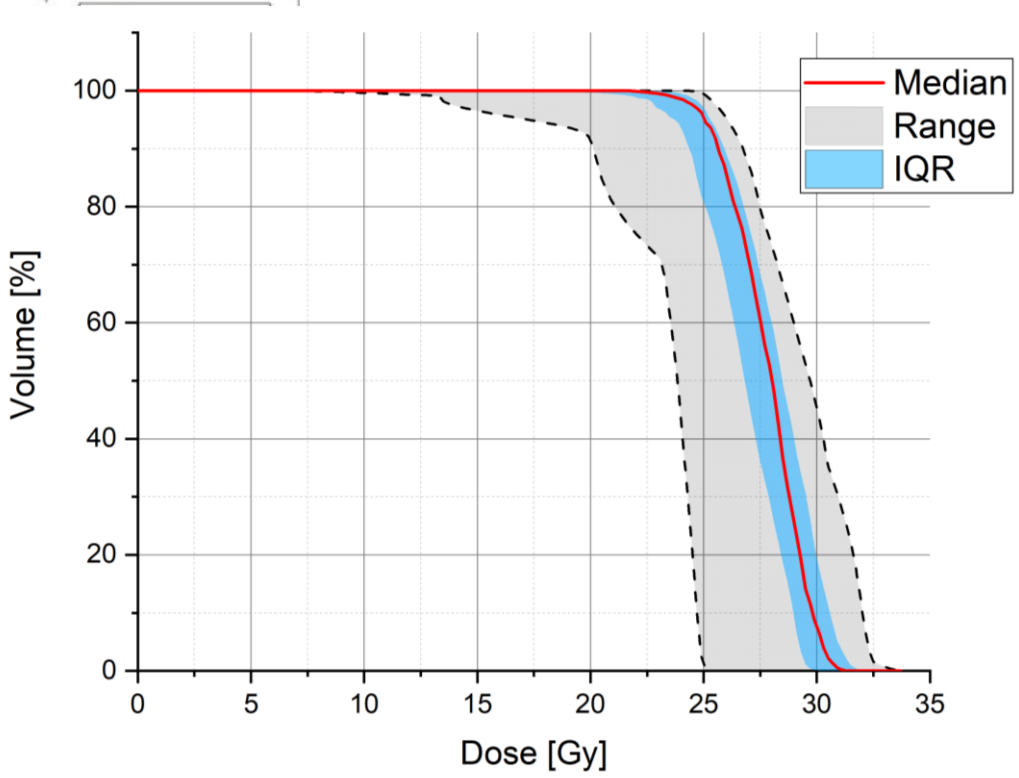
Stereotactic Arrhythmia Radioablation (STAR): STOPSTORM

STOPSTORM: Real-life Umbrella STAR registry with >50 partners and >18 clinical trials

Unpublished Interim Results: 193 prospective patients (> 300 total patients)

→ 12 related SAE (6.2%): Cardiac decompensation, pericardial effusion, Incessant VT





Stereotactic Arrhythmia Radioablation (STAR)

When is the Radiotherapy/-modulation/-ablation ready for clinical routine practice?

→ STAR with harmonized methodology is ***safe*** and can be ***highly effective***

→ Full deterministic radiation biological mechanisms of STAR are still ***unclear***

→ Definition of target volume and dose ***is being*** standardized and optimized

→ Criteria for optimal patient selection ***are being established***

→ Larger cohorts and RCTs ***will be*** evaluated soon

So, STAR is on the path to clinical routine practice!

Radiation Oncology is ready as a reliable partner!