

were either on Dual Antiplatelet Therapy (DAPT) or not on any anticoagulation preoperatively and all 4 of these were discharged on DAPT. Total time in the procedure room was 67 (± 22) minutes with 51 (± 22) minutes of anesthesia time. A single device was used in 92% ($n=11$). The mean LAA maximum size was 19 (± 3) mm with least device compression 20% (± 9). There were no complications. No patients had a peri-device leak at implant. One patient refused TEE at follow up. At follow-up imaging at least 45 days later there were no leaks >5 mm with 91% (10/11) having no leak and 1 patient having a 4mm leak.

Conclusion: Zero fluoroscopy TEE guided Watchman FLX implantation is feasible and safe with no perceptible decrease in efficiency.

B-PO04-150

SPATIAL VENTRICULAR GRADIENT IS ASSOCIATED WITH INDUCIBLE VENTRICULAR ARRHYTHMIAS DURING ELECTROPHYSIOLOGY STUDY

Nicolas Isaza, Hans F. Stabenau, Larisa G. Tereshchenko MD, PhD, FHRS, CCDS and Jonathan W. Waks MD

Background: The spatial ventricular gradient (SVG) is a vectorcardiographic measure of global electrical heterogeneity that has been associated with sudden cardiac death (SCD) in the general population. The association between SVG and inducibility of ventricular tachycardia (VT) or ventricular fibrillation (VF) during electrophysiology study (EPS) is unknown.

Objective: To test the association between SVG and inducible VT/VF during EPS.

Methods: We performed a retrospective study of patients presenting for EPS for evaluation of syncope or risk stratification of SCD prior to primary prevention ICD implantation between 6/2016-12/2020. 12-lead ECGs prior to EPS were converted to vectorcardiograms, and SVG magnitude, azimuth (direction in the XZ transverse plane), and elevation (direction in the XY frontal plane) were calculated. SVG components were dichotomized above and below their median values. Variables were compared with the t-test except for SVG azimuth (a circular variable), which was compared with the Mardia-Watson-Wheeler test. The odds of inducible VT/VF were regressed using a logistic model.

Results: Among 100 patients presenting for EPS (mean age 65.5 \pm 12.1 y, 77% male, mean LVEF 46 \pm 12%), 20 had inducible VT/VF. Patients with inducible VT/VF had lower LVEF (40 \pm 8 vs. 48 \pm 12%, $p=0.017$) and more posteriorly directed SVG azimuth (25.3 vs. 15.2 deg, $p=0.01$) than those who were non-inducible. Unadjusted logistic regression demonstrated that the OR for inducible VT/VF was 3.86 (95% CI 1.28-11.64, $p=0.017$) for SVG magnitude < 41.2 mv*ms and 8.07 (95% CI 2.19-29.78, $p=0.002$) for absolute SVG azimuth > 46.6 deg. SVG elevation, QRS duration, and QT interval were not associated with VT/VF. After adjustment for age, gender, LVEF, and prior MI, both SVG magnitude and absolute azimuth remained significantly associated with inducible VT/VF: adjusted OR for inducible VT/VF was 6.66 (95% CI 1.82-24.43, $p=0.004$) for SVG magnitude < 41.2 mv*ms and 7.53 (95% CI 1.81-31.35, $p=0.005$) for absolute SVG azimuth > 46.6 deg.

Conclusion: Smaller SVG magnitude and more extreme anterior or posterior SVG azimuth are associated with inducible VT/VF. SVG warrants prospective studies for risk stratification in patients undergoing EPS.

B-PO04-152

RISK OF SUDDEN CARDIAC DEATH IN COMPETITIVE ATHLETES DURING THE CONVALESCENT PHASE FOLLOWING COVID-19 INFECTION

Raul D. Mitrani MD, FHRS, CCDS, Jarrah Alfadhli MD, Maureen Lowery MD, Thomas Best MD, Joel Fishman MD,

Yoel Siegel MD, Joshua Hare MD, Robert J. Myerburg MD and Jeffrey J. Goldberger MBA, MD

Background: The incidence of myocarditis or other cardiac injury among athletes in the convalescent phase following COVID-19 infection ranges from 1%-15%.

Objective: To determine the risk for ventricular arrhythmias (VA) and/or sudden cardiac death during recovery from COVID-19 among competitive athletes.

Methods: We prospectively evaluated professional and collegiate athletes ($n=131$) for cardiac injury/myocarditis a median of 21 days (IQR 16-29) following diagnosis of COVID-19 infection. Athletes underwent history and physical exam, biomarker testing, ECG, cardiopulmonary exercise testing (CPET) combined with echocardiography, and targeted cardiac MRI for those with initial abnormal clinical findings.

Results: Of 131 athletes (102 males/29 females) with median age 21 years (IQR 19-22), 2 (20%) of 10 athletes with VA (≥ 2 premature ventricular complexes) during CPET were diagnosed with cardiac injury/myocarditis compared to 3 (2.5%) of 121 athletes without VA ($p=0.047$; Table 1). CRP, persistence of symptoms, and QRS ≥ 120 msec were also predictive of cardiac injury/myocarditis (Table 1). During a median follow-up of 69 (IQR 62-158) days, there have been no clinical sequelae among the 5 athletes (3.8%) diagnosed with cardiac injury/myocarditis who were totally restricted from exercise, as well as the 126 athletes who were cleared to train and compete.

Conclusion: We observed no arrhythmic events in athletes following COVID-19. Since we identified a small number of athletes with cardiac injury/myocarditis warranting restriction from exercise, the data suggests the need to carefully screen athletes prior to return to training or competition.

Comparison of athletes with and without diagnosis of myocarditis

	Myocarditis	No Myocarditis	p
N	5	126	
Median Age (IQR)	19 (19,20)	21 (19,22)	NS
Sex (M/F)	2/3	100/26	0.072
Elevated CRP	2	4	0.017
Persisting symptoms	3	9	0.005
QRS ≥ 120 msec	2	2	0.007
LVEF (%)	56.0 \pm 2.7	57.4 \pm 4.5	0.166
Ventricular ectopy	2	8	0.047

B-PO04-153

SUBTLE REPOLARIZATION ABNORMALITIES IN IDIOPATHIC VENTRICULAR FIBRILLATION ARE UNCOVERED BY NONINVASIVE ELECTROCARDIOGRAPHIC IMAGING, BUT NOT THE 12-LEAD ELECTROCARDIOGRAM

Matthijs J. Cluitmans MD, PhD, Bianca van Rees, Job Stoks MS, Uyen Nguyen, Rachel M.A. ter Bekke MD, PhD, Casper Muhl and Paul G.A. Volders MD, PhD

Background: Sudden cardiac arrest is most often due to ventricular fibrillation (VF). When no cause is found during diagnostic follow-up, fibrillation is classified as idiopathic VF. We hypothesize that subtle repolarization abnormalities may predispose to idiopathic VF, but cannot be detected from the 12-lead electrocardiogram (ECG).

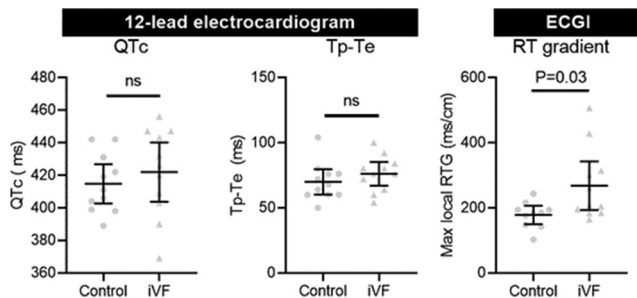
Objective: To study the presence of repolarization time (RT) gradients in patients with idiopathic VF using the 12-lead ECG and noninvasive electrocardiographic imaging (ECGI).

Methods: In control individuals without cardiovascular disease and in survivors of idiopathic VF, we manually determined the heart-rate corrected QT interval (QTc) and the interval from

peak-to-end of the T wave (Tp-Te) from the 12-lead ECG. ECGI was performed with a custom-made setup to noninvasively map RT isochrones on the epicardium and determine the maximum local RT gradient (RTG).

Results: We included 10 control individuals and 11 survivors of idiopathic VF (iVF). Figure 1 shows that both QTc and Tp-Te from the 12-lead ECG did not differ between these groups. However, ECGI uncovered steeper maximum RT gradients in survivors of idiopathic VF compared to controls ($P=0.03$).

Conclusion: Noninvasive ECGI, but not the standard 12-lead ECG, can uncover RT abnormalities in survivors of idiopathic VF. Steeper RT gradients could play a role in the induction of VF through unidirectional conduction block. Noninvasive ECGI may improve the mechanistic understanding and risk assessment of patients with apparently idiopathic VF.



B-PO04-154

TIME OF DAY OF VENTRICULAR TACHYARRHYTHMIAS AFTER MYOCARDIAL INFARCTION: RESULTS FROM THE VEST TRIAL

Christopher C. Cheung MD, Mason Lai, Jeffrey E. Olgin MD, FHRS, Mark Pletcher MD, MPH, Trisha F. Hue MPH, PhD, Eric Vittinghoff PhD, Feng Lin and Byron K. Lee MD

Background: Sudden cardiac death is common in the early post-myocardial infarction (MI) period. It is not known if ventricular tachyarrhythmias (VT/VF) are more common in certain parts of the day.

Objective: To analyze the time of day of VT/VF events leading to appropriate shocks among participants in the VEST Trial.

Methods: In the VEST trial, patients with MI and an ejection fraction of $\leq 35\%$ were randomized to a wearable cardioverter-defibrillator (WCD) plus guideline-directed medical therapy (GDMT), or GDMT alone. Among those with VT/VF leading to appropriate shocks, their demographics, comorbidities, and timing of shocks were summarized.

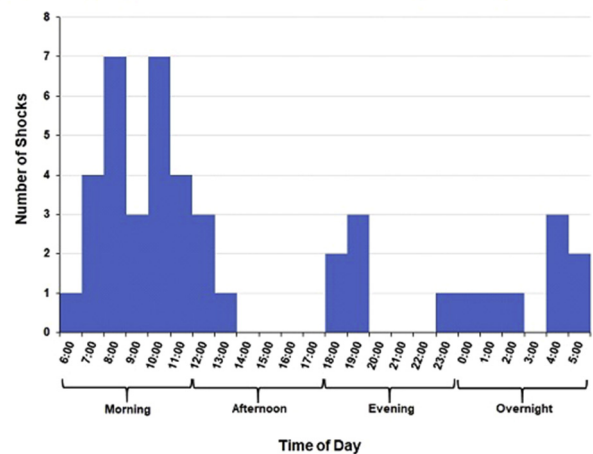
Results: Among 2302 participants in the VEST trial, 21 participants had an appropriate shock. The median age was 55.3 years (interquartile range [IQR] 50.5-64.4), with 86% male. The median body-mass index was 28.1 kg/m² (IQR 26.0-33.3). Comorbidities included diabetes (52%), hypertension (38%), and prior MI (33%). Participants had a post-MI ejection fraction of $<25\%$ (43% of participants) or 25-35% (57%).

There were 44 appropriate shocks for VT/VF, with a median of 1 (IQR 1-3) shock(s) per participant. Shocks were most common in the morning (6am-12pm, 59%, Fisher's exact $p<0.001$;

Figure), compared to other time periods: afternoon (12pm-6pm, 9%), evening (6pm-12am, 14%), and overnight (12am-6am, 18%). The first shock by WCD was successful in all VT/VF episodes; however, 6/21 (29%) participants died during the 3-month follow-up.

Conclusion: In patients with recent MI, VT/VF occurred more frequently during the morning hours, possibly related to sympathetic surges. Therapies aimed at decreasing morning sympathetic surges may be beneficial.

Figure. Appropriate Shocks in VEST Trial Participants by Time of Day



B-PO04-155

RECURRENT OUT-OF-HOSPITAL SUDDEN CARDIAC ARREST: BURDEN AND ASSOCIATED FACTORS

Elizabeth Held MD, Kyndaron Reinier PhD, MPH, Harpriya Chugh BS, Audrey Uy-Evanado MD, Eric Stecker MD, MPH, Jonathan Jui MD, MPH and Sumeet S. Chugh MD, FHRS

Background: Despite major improvements in management of sudden cardiac arrest survivors and wide availability of implantable defibrillators for secondary prevention, a subgroup of individuals will suffer separate, multiple episodes of sudden cardiac arrest (SCA) over time.

Objective: We evaluated the burden and determinants of recurrent SCA in the community.

Methods: SCA cases were prospectively ascertained in a large, ongoing population-based study in the US Northwest (2002-2019, catchment population approx. 1 million). Individuals that experienced recurrent SCA were identified and a comprehensive review was performed of their clinical history, management and approach to secondary prevention. We conducted a detailed comparison between subjects that suffered recurrent SCA and those that survived a single SCA.

Results: Of 5630 individuals with SCA from 2002-2019, there were 711 survivors to hospital discharge (12.6%) and 123 individuals with multiple SCA (age 61.9 \pm 14.0 years at time of first arrest; 69.1% male). The median time interval between the first and second SCA was 22 months (range 6 days - 31 years). Ten of the 123 subjects suffered a third SCA (median 21 months, range 18 days - 5.4 years). Compared with SCA survivors who suffered only a single arrest, multiple arrest victims were more likely to have a pre-existing history of diabetes (44% vs 25%, $p<0.001$) and kidney disease (35% vs 13%, $p<0.001$). Those with multiple arrests had lower rates of coronary revascularization (14.6% versus 25%, $p=0.018$) and lower rates of implantable cardioverter-defibrillator (ICD) implantation (22% vs. 58%, $p<0.001$) following initial cardiac arrest.

Conclusion: A distinct subset of SCA survivors (17%) had recurrent SCA with a median time interval of 22 months. ICDs were underutilized in this group, and diabetes and renal disease were identified as predictors of increased risk. These findings have implications for secondary prevention of sudden cardiac death.