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Young Investigators Competition – Clinical Science

1/Optimization of Ablation Outcome with Ventricular Tachycardia Ablation Pathway: The VITALITY Study

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr1

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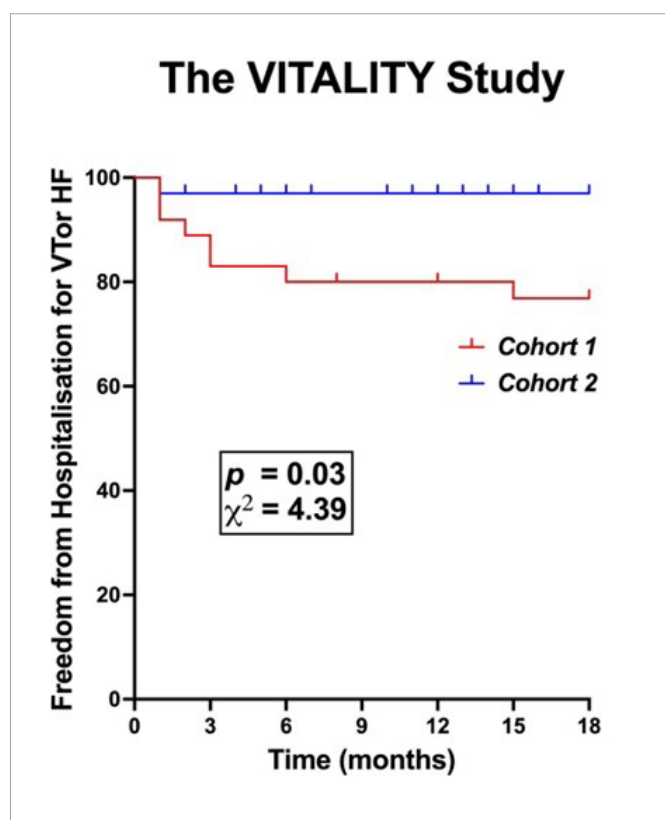
Background: Catheter ablation (CA) of ventricular tachycardia (VT) reduces ICD therapies in patients with VT due to structural heart disease (SHD). A structured ablation pathway may guide pre-ablation optimization of antiarrhythmic drugs (AAD) and ICD programming. We aimed to investigate impact of an ablation pathway on VT ablation outcome.

Methods: The study recruited consecutive patients with SHD undergoing VT ablation before (Cohort 1, 2015–2020) and after (Cohort 2, 2020–2022) the introduction of a VT ablation pathway. Cohort 2 had beta-blocker up-titration following first anti-tachycardia pacing. After first ICD shock, patients were started on class III AADs. Patients with ischaemic cardiomyopathy (ICM) were offered CA. Patients with non-ICM (NICM) had CA after second ICD shock. Potential demographic and clinical predictors of hospitalization for VT or heart failure (HF) were assessed. Cox regression and Kaplan-Meier analyses were performed.

Results: Demographics were similar between Cohorts 1 and 2 (n=76 versus 43; age 60.5 ± 15.0 versus 59.3 ± 14.3 years; EF $39.2 \pm 12.3\%$ versus $38.5 \pm 10.1\%$; NICM 57% versus 49%; PAAINESD 12.7 ± 6.5 versus 13.5 ± 7.1). Prior to CA, Cohort 2 received fewer ICD shocks (0.75 ± 0.87 versus 7.0 ± 8.9 , $p < 0.01$). Following ablation, fewer patients in Cohort 2 remained on ≥ 1 AAD (3.6% versus 42.5%, $p < 0.01$), experienced VT (34.6% versus 51.4%, $p < 0.05$) and ICD shocks (6.9% versus 21.6%, $p < 0.05$). At 18 months, 93.5% of Cohort 2 versus 72.5% Cohort 1 were free of hospitalization from VT or heart failure ($p < 0.05$). Cohort 2 (HR=0.01, $p < 0.05$) and mappable VT (HR=0.31, $p < 0.05$) independently predicts freedom from hospitalization for VT or HF.

Conclusion: Pre-ablation optimization of AAD and ICD programming through a VT ablation pathway improves VT ablation outcomes in patients with SHD. Future mechanistic studies to investigate upstream optimization of VT ablations are required. □

Figure 1





Young Investigators Competition – Clinical Science

2/Machine learning integrating chest radiographic imaging to predict major adverse events following transvenous lead extraction

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr2

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Background: Risk models have been utilised to predict major adverse events (MAEs) following transvenous lead extraction (TLE). We evaluated whether applying machine learning (ML-) techniques incorporating chest radiographs increased the ability of existing models to predict MAE (defined as procedure-related major complication and procedure-related deaths).

Methods: Two models were assessed whether ML would improve risk prediction compared to an existing risk score. Model 1: we designed and evaluated a ML-based risk model trained on the European ELECTRA registry of 3,555 patients undergoing TLE. This was tested on an independent registry of 1,171 patients undergoing TLE from our institution. This was compared with the published Electra Registry Outcome Score (EROS) – a risk score based on the ELECTRA registry. Pre-procedural demographic, clinical, device and lead variables were included. A self-normalising neural network (SNN), stepwise logistic regression, support vector machines (SVM) and random forest (RF) models were compared to the performance of EROS. Model 2: we integrated geometric features identified using artificial intelligence (AI) from a pre-procedure anterior-posterior (AP) chest x-ray (CXR) into model 1. The method of identifying geometric features is illustrated in the figure. We evaluated if incorporating imaging data from a CXR could improve the model's predictive capability.

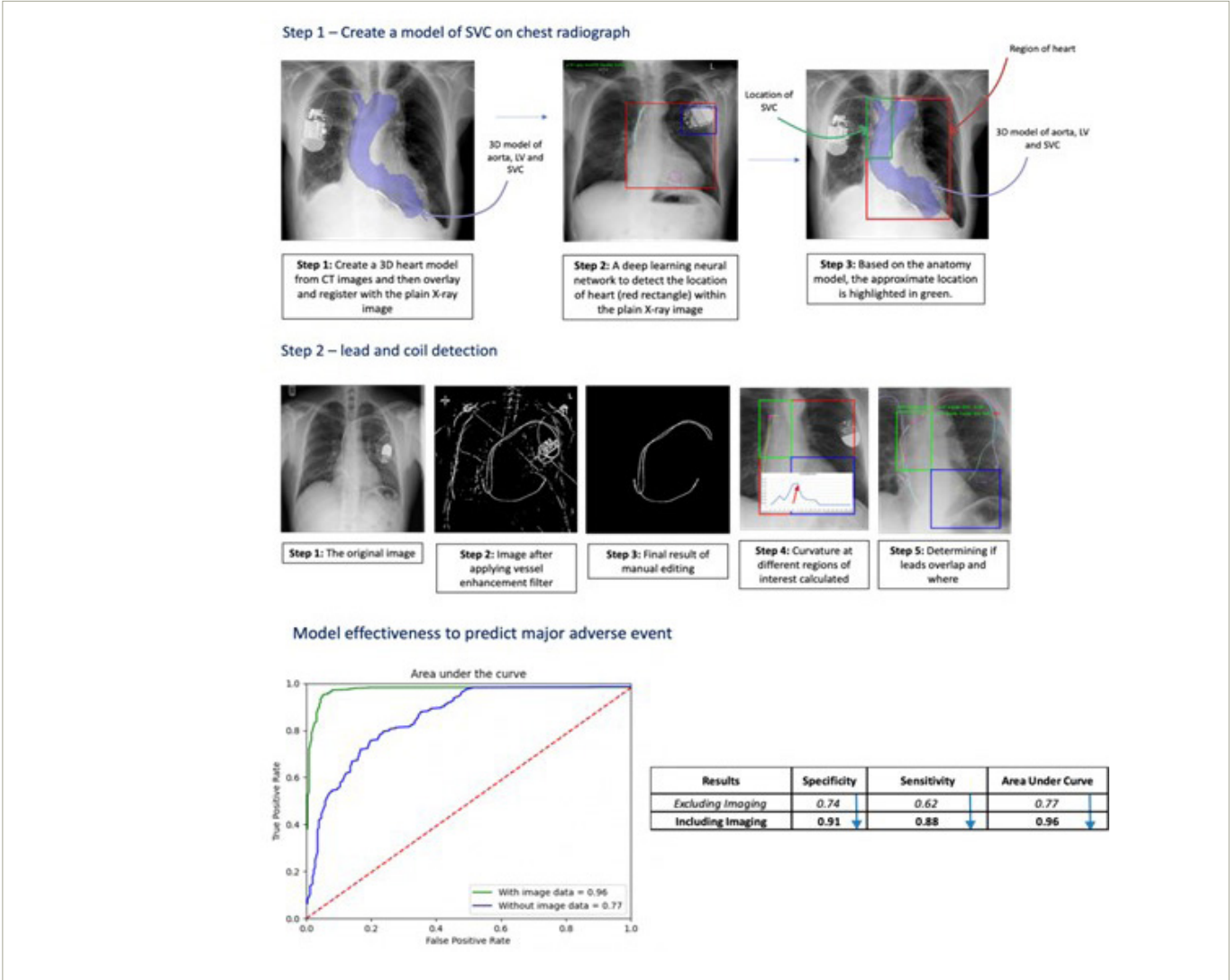
Results: Model 1: there were 53 MAEs (1.7%) in the training cohort

and 24 (2.4%) in the test cohort. Thirty-two clinically important features were used to train the models. ML techniques without incorporating radiographic imaging data were similar to EROS by balanced accuracy (stepwise logistic regression: 0.74 versus EROS: 0.70) and moderately superior by area under the curve (AUC) (SVM: 0.764 versus EROS: 0.677). Model 2: 1,050 cases out of the 1,171 patients at our institution had pre-extraction CXRs suitable for ML analysis. The computer vision algorithm was able to detect: i) the heart border: with 100% accuracy, ii) ICD coils: 98% accuracy, iii) acute angulation in the right ventricle (RV): 91% accuracy, iv) acute angulation in the superior vena cava (SVC): 70% accuracy. The following features correlated with MAEs: i) >50% of the ICD coil within the SVC, ii) >2 overlapping leads in the SVC, iii) acute RV lead angulation. Using these imaging features in the ML-model significantly improved prediction of MAEs: i) balanced accuracy from 0.74 to 0.91, ii) sensitivity from 0.62 to 0.88, iii) specificity from 0.73 to 0.90, and iv) AUC from 0.77 to 0.96.

Conclusion: Integration of imaging biomarkers from a plain AP CXR into risk prediction tools significantly increases the ability of ML models to predict risk of MAE following TLE. This may be integrated into heart team decision-making regarding extraction risk and resource allocation. Using these novel techniques in richer imaging data such as CT or fluoroscopy could provide more accurate ML- risk prediction models. □



Figure 1





Young Investigators Competition – Clinical Science

3/Assessment of coronary perfusion, central and peripheral haemodynamics during simulated ventricular tachycardia and its potential application to implantable cardioverter defibrillators

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr3

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Background: Extending implantable cardioverter defibrillator (ICD) detection windows improves outcomes by reducing unnecessary therapies; a 1% reduction in therapies results in ~1% reduction in mortality. However, waiting too long for episodes to self-terminate may prolong cardiac ischaemia, which could compromise the effectiveness of ICD treatments. We have previously shown that laser Doppler perfusion monitoring, combined with an electro-mechanical coupling algorithm to reduce the impact of noise (SafeShock), can be used to assess peripheral perfusion. This method allows reliable detection of haemodynamic compromise during ventricular fibrillation. However, the impact of ventricular tachycardia (VT) on central and peripheral haemodynamics and its potential application to ICD therapies has not been previously studied. We assessed coronary blood flow (CBF), central pressure and peripheral perfusion (PP) during simulated VT.

Methods: In patients having a coronary angiogram, we simulated VT by pacing the right ventricle at rates of 180 and 200 bpm. We recorded continuous ECG, invasive CBF and central aortic blood pressure (cAoBP), and non-invasive peripheral laser Doppler perfusion. Coronary vascular resistance (CVR) was calculated by dividing CBF by the mean aortic pressure. We assessed the haemodynamic impact during the first 30 s and second 30 s (30–60 s) of VT, relative to baseline. Laser Doppler data was analysed using the SafeShock algorithm. We used a cut-off of 5.2 au to assess its ability to discriminate severe haemodynamic compromise during VT (defined by a reduction in cAoBP \geq -35%) from those without.

Results: We simulated 61 VT episodes in 19 patients (mean age 64, left ventricular ejection fraction \leq 40% in 6 patients [32%]). We observed a mean reduction in CBF during the first 30 s of VT (-15%, $p < 0.0001$), but in

the next 30 s, mean flow increased above baseline (+ 12.5%, $p = 0.002$). CVR reduced during the 30–60 s window (-12.6%, $p < 0.0001$), possibly aiding autoregulation of CBF.

cAoBP and PP also decreased in the first 30 s of VT, but by a greater magnitude than CBF: -50.7% cAoBP, -91% PP (both $p < 0.0001$). However, in contrast to CBF, both cAoBP (-39%) and PP (-85%) remained below baseline after 30 s of VT.

Haemodynamic responses during VT episodes varied. In the first 30 s of VT, CBF was preserved in 29.5% of VT episodes, whereas by 30–60 s, flow recovered in 75.4%.

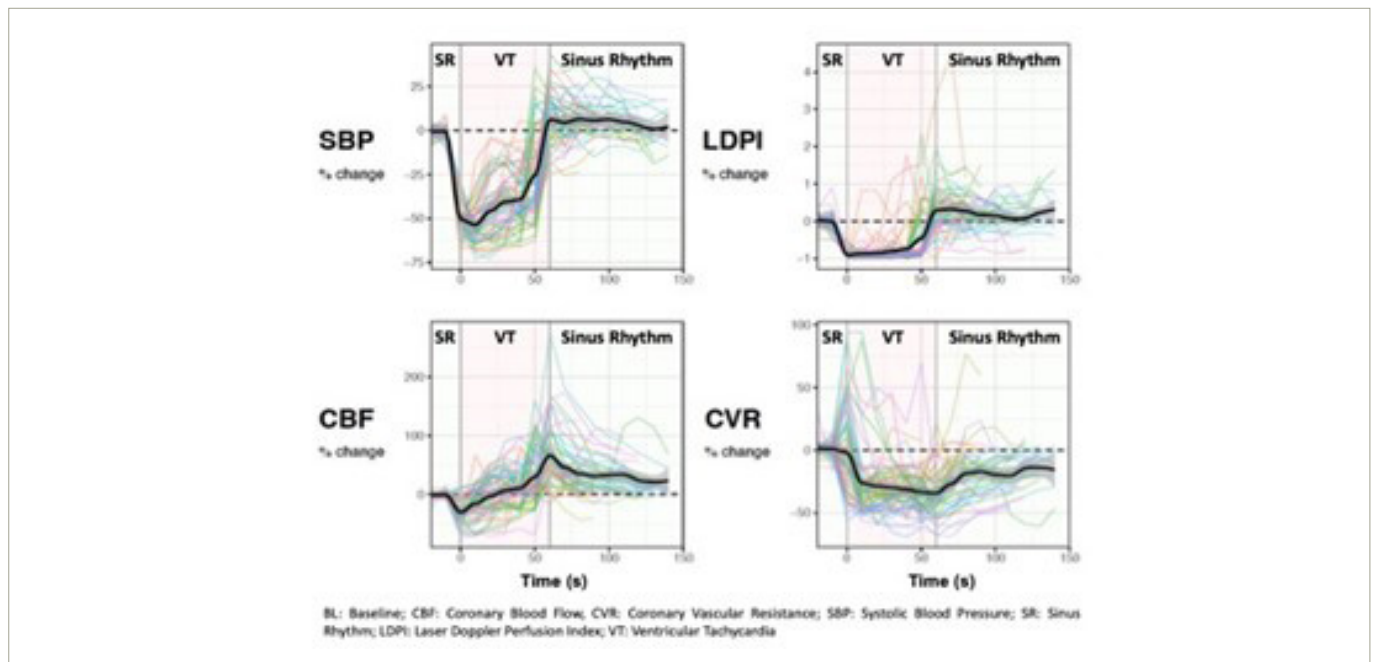
We observed a $<35\%$ reduction in cAoBP and PP in 6.6% and 0% of VT episodes, respectively, in the first 30 s, and in 37.5% and 0% in the next 30 s.

We investigated the utility of using peripheral Laser Doppler perfusion measurements to differentiate between VT with and without severe haemodynamic compromise. Using a threshold of >5 au (which is independent of baseline measurements) as the threshold for withholding ICD therapies, provided an 11% reduction in ICD therapies, and did not result in therapies being withheld during episodes with severe haemodynamic compromise or a fall in CBF (sensitivity 100%, specificity 33.3%).

Conclusion: Coronary blood flow was preferentially protected during VT and preserved in over 2/3 of VT episodes with rates of 180 and 200 bpm. This suggests these ICD therapies could be safely withheld without prolonging cardiac ischaemia. Utilising a haemodynamic sensor could reduce unnecessary therapies by identifying VT episodes without severe haemodynamic compromise. □



Figure 1



Young Investigators Competition – Basic Scientist

4/Restitution threshold index – A novel parameter to characterize AF-mediated ventricular dysfunction

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr4

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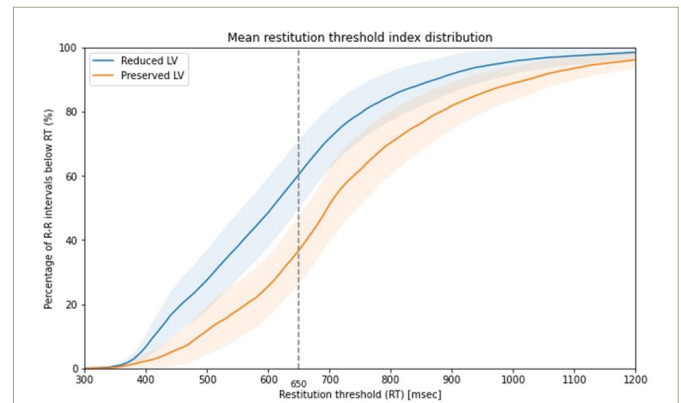
Background: Patients with persistent atrial fibrillation (AF) may experience reduced left ventricular ejection fraction (LVEF) despite rate-control. The non-normal distribution of R-R intervals may be poorly represented by the mean heart rate and a non-parametric measure of the proportion of short R-R intervals may more sensitively characterize the AF-mediated component of left ventricular systolic dysfunction.

Purpose: To evaluate the restitution threshold index (RTI); a novel parameter that reflects the proportion of short R-R intervals in patients with AF with reduced and preserved LVEF.

Methods: Patients undergoing first-time catheter ablation for persistent AF were prospectively enrolled. Patients were dichotomised as reduced versus preserved LVEF using an LVEF of 50% as cut-off. Holter monitoring was performed prior to the ablation with a supervised and standardised initial recording period to minimize confounders. The Restitution Threshold (RT) refers to the assumed minimum cycle length duration required for complete mechanical restitution and filling of the left ventricle. This threshold is unknown and was tested in both cohorts across a range of 300 ms and 1200 ms at 10 ms increments. A high proportion of R-R intervals below the actual RT could lead to acute LVSD and impaired contractility. This proportion of intervals below the RT was defined as the RTI. Multi-variate logistic regression modelling was used to assess the relationship between the RT with maximum separation of RTI between the two cohorts and pre-defined co-variables (mean heart rate, indexed left atrial volume, age, sex, beta-blocker and amiodarone use)

Results: 46 patients were included, with 22 in the preserved LVEF arm and 24 in the reduced LVEF arm. There was significant difference in RTI between the two arms at all RTs between 450–900 ms. (Figure 1) Maximum separation was observed at an RT of 650 ms, with patients with reduced LVEF exhibiting a significantly higher RTI ($60.5\% \pm 24.7\%$

Figure 1: Mean restitution threshold index distribution



The distribution of R-R intervals in patients with reduced left ventricular (LV) function (blue) and preserved LV function (orange) during persistent AF plotted as mean (line) and two standard errors of the mean (shaded area). This is shown for a range of values for the RT. The dotted line represents the point of maximum separation at 650 ms.

versus $36.8\% \pm 24.3\%$, $p=0.002$). RTI was an independent predictor of patients with reduced LVEF on multi-variate analysis ($B=0.038$, $p<0.01$), whereas mean heart rate was not.

Conclusions: This exploratory study demonstrates feasibility of RTI as a novel parameter characterising the proportion of short R-R intervals may better identify patients with LVSD in persistent AF, with an RT of 650 ms performing best in our cohort. RTI may have potential clinical application in selecting patients with tachycardia-induced cardiomyopathy, but further validation is required. □



Young Investigators Competition – Basic Scientist

5/Developing a 3D biventricular scar navigational tool from cardiac MRI using artificial intelligence

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr5

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Introduction: 3D models derived from late gadolinium-enhanced cardiac magnetic resonance imaging (LGE-CMR) can reduce ventricular tachycardia (VT) ablation procedure times and improve outcomes. Clinician-led manual segmentation is time and resource intensive. However, neural networks can be trained to identify and segment cardiac structures, mimicking clinician decisions, whilst operating at a fraction of the time with little to no inter-operator variability. Most published segmentation models are limited by small training datasets, restricted labelling outputs (usually left ventricle only) and often lack correlated clinical data. We aimed to develop an artificial intelligence biventricular geometry and scar segmentation model addressing these limitations.

Methods: Clinically indicated LGE-CMR in those with ischaemic scar were retrospectively identified, following ethical approval. Clinical data was extracted from healthcare records. Ground-truth manual CMR segmentation of seven labels was performed – left ventricular (LV) myocardium, LV blood pool, LV scar, aorta, LV papillary muscles, right ventricular (RV) myocardium and RV blood pool.

A neural network was developed utilising transformers, zero-centre normalization, average of dice loss and weighted cross entropy. LGE-CMR datasets were separated into a 70:10:20 split for training, validation and testing respectively. Results were assessed using Dice co-efficient and average symmetric surface distance (ASSD).

Results: Four hundred LGE-CMR from 2017 to 2021 were labelled, 362 obtained from a 1.5T Philips Ingenia and 38 from a 1.5T Siemens Aera. Median slice number per scan was 11, with 10 mm slice thickness. This resulted in a total of 4,515 slices, of which 2,373 (52.6%) were labelled

‘optimal’ quality and only 144 (3.19%) ‘uninterpretable’. All images were 2D and did not utilize compressed sense (or equivalent).

Median age was 66 years (56–74), with a male predominance (80.5%). Cardiac devices consisting of implantable cardioverter defibrillators (7) and pacemakers (5) were present in 12 (3%) patients. One hundred and fourteen (28.5%) had diabetes and 153 (38.3%) had previous cardiac stenting. A history of previous, confirmed, ventricular arrhythmia was present in 15 (3.8%).

The overall mean Dice was 0.667 and mean ASSD was 1.52 mm. The left ventricular blood pool had the highest mean dice (0.888) and second lowest mean ASSD (0.818 mm). Scar had a mean dice of 0.439 and a mean ASSD of 2.416 mm.

Conclusion: This model trained on a large 2D, disease-specific dataset demonstrates scar labelling performance similar to previously published models with the advantage of multiple structure segmentation and a geometrical 3D output that can be imported into electro-anatomical mapping systems as a navigational aide. Furthermore, the dataset included varied ‘real-world’ image quality in the most common cause of ventricular scar and included patients with implanted cardiac devices, often excluded in other published models.

Further development and training of the model using higher resolution LGE-CMR studies is currently underway (NotIs CMR study, IRAS:298151), recruiting prospective IHD scans from multiple CMR manufacturers using different acquisition settings to improve future generalizability and applicability in the clinical setting. Concurrent paired clinical data is being collected for future use in risk prediction modelling. □

Figure 1: Example of AI performance

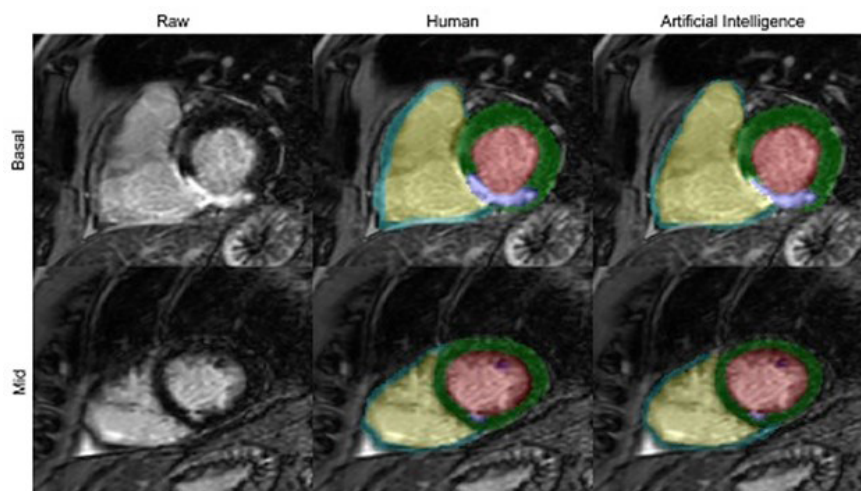


Figure 1. Example of AI performance. Cardiac MRI with transmural basal inferoseptal and inferior scar (left) with human delineation of structures (middle) and AI delineated structures (right). Red – left ventricular blood pool, Green – left ventricular myocardium, Blue – scar, Yellow – right ventricular blood pool, Cyan – right ventricular myocardium.



Young Investigators Competition – Basic Scientist

6/Neural network-derived electrocardiographic features predict mortality and future malignant arrhythmia and conduction disease

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr6

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Background: Subtle, prognostically-meaningful ECG features may not be apparent to physicians. In the course of supervised machine learning (ML) training, many thousands of ECG features are identified. These are not limited to conventional ECG parameters and morphology. These novel NN-derived ECG features may have clinical, phenotypic and genotypic associations and prognostic significance.

Methods and results: We extracted 5,120 NN-derived ECG features from an AI-ECG model trained for six simple diagnoses and applied unsupervised machine learning to identify three phenogroups. The derivation set, the Clinical Outcomes in Digital Electrocardiography (CODE) cohort (n=1,558,421), is a database of ECGs recorded in primary care in Brazil. There were five external validation datasets; Whitehall II (civil servants, n=5,066), UK Biobank (volunteers, n=42,386), ELSA-Brasil (public servants, n=13,739), SaMi-Trop (patients with chronic Chagas cardiomyopathy, n=1,631) and Beth Israel (BIDMC) (secondary care population, n=188,972).

In the derivation cohort (CODE), the three phenogroups had significantly different mortality profiles. After adjusting for known covariates, phenogroup B had a 1.2-fold increase in long-term mortality compared to phenogroup A (HR: 1.20, 95% CI 1.17–1.23, $p < 0.0001$). Importantly, the predictive ability of the phenogroups was retained in a group without any of the six diagnoses for which CODE-CNN was originally trained and in a group with clinician-reported normal ECGs.

We then externally validated our findings in five diverse, multi-ethnic cohorts. We found phenogroup B had a significantly greater risk of mortality in all five external cohorts.

We performed a phenome-wide association study (PheWAS) of clinical diagnoses in the BIDMC dataset. Phenogroup B was associated with

a significantly higher rate of future atrial fibrillation, ischaemic heart disease, atrioventricular block, cardiomyopathy, ventricular tachycardia and cardiac arrest. PheWAS of imaging phenotypes showed phenogroup B was associated with increased cardiac chamber volumes and carotid intima-media thickness, and decreased cardiac output and left ventricular strain.

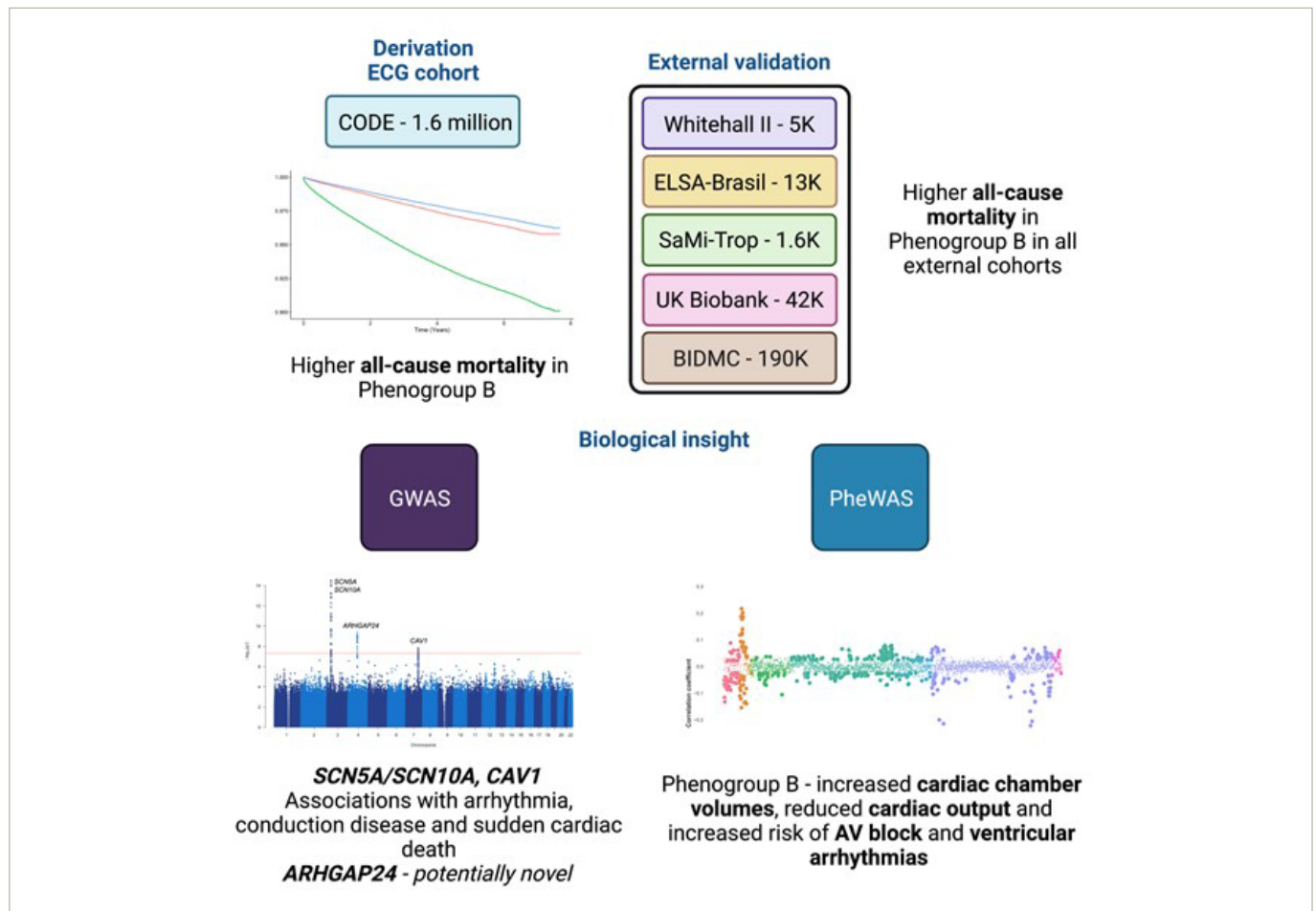
A single-trait genome-wide association study (GWAS) was conducted. The GWAS yielded four loci. SCN10A, SCN5A and CAV1 have well described roles in cardiac conduction and arrhythmia. The cardiac role of ARHGAP24 is unclear and is a potentially novel finding.

In order to better understand the reasons for phenogroup classification by the hybrid ML model, we used a modified Grad-CAM approach. The terminal part of the QRS complex and T wave were most important for identification of the high-risk phenogroup (phenogroup B). These may represent myocardial conduction slowing and repolarization heterogeneity respectively.

Conclusion: We describe the use of NN-derived ECG features, to identify prognostically-significant phenogroups from the 12-lead ECG. We explored the biological basis underlying the difference in prognosis between the phenogroups, and identified phenotypic and genotypic associations through PheWAS and GWAS. We validated our findings in five external datasets across two continents and diverse patient populations. NN-derived ECG features have important applications beyond the original model from which they are derived and may be transferable and applicable for risk prediction in a wide range of settings, in addition to mortality prediction. □



Figure 1





Oral Abstracts 1 – Allied and Service Development

7/Does a physiologist led response to cardiac implantable electronic device detected high-rate atrial episodes lead to appropriate anticoagulation in primary care?

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr7

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Introduction: Atrial fibrillation (AF) is the most common cardiac arrhythmia. Estimated prevalence in England is 2.5% and increases with age. It is associated with a five-fold increase in stroke risk. Anticoagulation can reduce this risk by 64%.¹ Guidelines recommend anticoagulation for patients with paroxysmal or persistent AF who are at risk of stroke. The National Institute for Health and Care Excellence recommends risk calculation using the CHA2DS2-VASc score and consideration of anticoagulation for the presence of a risk factor other than sex.

Routine cardiac implantable electronic device (CIED) follow-ups can determine the frequency and duration of atrial high-rate episodes (AHRE), which independently carry a stroke risk and are frequently due to AF. AHRE could represent subclinical AF and are associated with increased risk of future clinical AF. A high burden at diagnosis correlates with a greater incidence of progression of disease over 6 months.¹ The precise duration of AHRE requiring anticoagulation is unclear and is unlikely to be a simple function of duration. However, durations of 6 minutes are associated with increased stroke risk. European Society of Cardiology guidelines suggest considering anticoagulation in high-risk patients with AHRE over 1 hour.

Our local physiologist-led protocols state that when a CIED check reveals episodes of AHRE consistent with AF lasting longer than 6 minutes, the general practitioner (GP) is contacted to suggest they consider anticoagulation.

Methods: A retrospective analysis of trust patients who underwent a CIED check between January 2021 and May 2022 was performed to assess GP response to letter receipt. All patients with AHRE over

6 minutes and their GP notified were included (n=42). CIED interrogation results and electronic records were analysed for AHRE duration, CHA2DS2-VASc score, anticoagulation decision and the time until subsequent treatment. For those not anticoagulated, records were assessed for a reason why not.

Results: Of the patients studied, 88% had the notification acknowledged in their GP records; 76% were anticoagulated. These patients had a CHA2DS2-VASc score ranging from 1 to 8. Ten per cent were not anticoagulated due to anaemia, melaena, malignancy, falls risk, cognitive impairment and poor swallow. These patients had CHA2DS2-VASc scores of 3 to 7 and a relative contraindication or high ORBIT score recorded. Two per cent were lost to follow up, untreated, after GP acknowledgement of notification. The median delay in anticoagulation from GP notification was 23.5 days (IQR: 10.75–48.7). The duration of AHRE episodes ranged from 8 minutes to 21 days. Eighty-three per cent of patients had AHRE duration greater than 1 hour. There were no adverse AF-related outcomes identified in GP records in the time between identification of AHRE and treatment starting.

Discussion: The presence of AHRE in patients undergoing CIED interrogation carries a risk of stroke and predisposes them to future clinical AF. There is an adequate response by GPs to physiologist led alerts to AHRE, demonstrated by a high rate of prompt anticoagulant prescription. Further investigation into AHRE burden and stroke risk could contribute to clearer guidance on when to anticoagulate in patients with subclinical AF. □

1. Hindricks G, Potpara T, Dagres N, et al. 2020 ESC guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): The Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. *Eur Heart J*. 2021;42:373–498.



Oral Abstracts 1 – Allied and Service Development

8/A new magnetic resonance imaging (MRI) referrals platform for patients with cardiac devices

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr8

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Introduction: There are half a million people with cardiac pacemakers in the UK who are denied access to magnetic resonance imaging (MRI) when clinically indicated. Patients are fifty times less likely to be referred and there is a thirty-fold service under provision because provision is logistically difficult – it needs experts in both MRI and cardiology to work together. This has serious consequences (e.g. cancer care and stroke). There is a national shortage of physiologists in the UK and their time is needed to plan scans, review device details, check devices pre- and post MRI and communicate at multiple time points to multiple professional teams.

Methods: Barts developed a unique platform, called PaceMRI, created by healthcare professionals for healthcare professionals with support from medical professional bodies and patient charities. The platform has been designed to facilitate referrals when clinically indicated, identify and explain risks to patients and referrers, streamline collecting device information and automatically look up MRI protocols based on the scenario and device implanted following UK guidelines. Changes to the platform have been staged with iterative feedback during service use. Paired parametric tests were used to compare data 6 months pre- and post-platform implementation. A questionnaire was given to patients with implanted cardiac devices (bradycardia and tachycardia devices) to assess the requirement and importance of digital device ID cards.

Results: Patient benefits: Patients have benefitted from faster access to clinically vital MRI scans. The median time from a clinical decision that a scan was required to the scan occurring, for outpatients within our trust, reduced to 24 days (inter-quartile range [IQR]: 18–33) from 28 days (IQR

7–60) ($p=x$) after platform implementation. For all patients, the median time from the referral being received to the scan being performed reduced to 13 days (IQR: 7–20) from 15 days (IQR: 8–32, $p=ns$). Despite the increased service and logistical demands, this is superior to the average national wait times from referral to scan for general MRI (20 days [NHS diagnostic waiting times, September 2022]). The number of patients waiting for longer than 6 weeks from referral to scan is also lower than the national average for general MRI (14% versus 23.9%).

Service benefits: Utilising PaceMRI has increased service provision and widened access. 385 referrals were received and 129 scans were completed (from 22 centres, 5 of which had not referred previously) over a 6-month period. Referrals increased from 5.6 ± 1.6 to 6.6 ± 2.2 per week ($p=0.003$), with more external referrals after implementation (53–78%, $p<0.05$). Most referrals were from Greater London, from non-cardiology referrers (53–64%, $p<0.05$), with 64% urgent and 16% inpatient requests (pre-implementation: 63% and 23% respectively, $p=ns$). 29% of scans were requested as part of cancer diagnosis or management (30% pre-implementation, $p=ns$). The quality of referral also increased; referrers correctly identified device information in 74% of referrals, were unsure in 14% and provided inadequate information in 37% (compared with 37%, 58% and 76% respectively pre-implementation, $p<0.05$). There were no MRI related device complications despite this increase in service use.

Conclusions: A referrals management platform has demonstrated access to MRI for patients with pacemakers, saves time for referrers and service providers whilst facilitating safe MRI provision. □



Oral Abstracts 1 – Allied and Service Development

9/Ward-based implantable cardiac monitor insertion: Time to leave the catheter lab?

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr9

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Introduction: With the ever-increasing importance of home monitoring for the follow-up of cardiac implanted electronic devices (CIED), emphasised during the COVID pandemic, the workload for CIED follow-up clinics has grown exponentially. The demand on services is exceeding resource, with innovative solutions needed to maximise efficiency, safety and quality. One potential solution has been offered by Medtronic in the form of a third-party triage/interpretation service called Focus On™. This service is linked to the clinic's Carelink™ server, and they receive home monitoring downloads from the entirety or subset of Medtronic devices that are remotely monitored. They triage and interpret this information based on clinical significance. The information is returned to the follow-up clinic, classified as Green, Amber or Red based on clinical relevance, with email and/or telephone alerts to the clinic for Amber and Red alerts. Green alerts are those deemed to have no clinical relevance, with a recommendation that no extra clinic time is spent reviewing these reports. The service is promoted as not only a significant time saver, but also ensuring timely review and actioning of clinically significant data. Articles have been published confirming the same, although, to this author's knowledge, no data have been published regarding the clinical accuracy of the Focus On™ service reports.

Aims: To assess the diagnostic accuracy of the Green alerts labelled as such by FocusOn™.

Methods: This was a retrospective 6-month audit of Reveal Linq Green alert downloads, which would normally have no secondary review from the device clinic. As all Amber and Red alerts receive clinic review, they were not included in our audit. Within that period, 6750 Green

alert downloads were received (out of a total of 7780 transmissions), although only 3537 of those downloads had interpretable data (other alerts received for device battery RRT/atrial arrhythmia burden/patient downloads with no episodes etc.). A total of 500 downloads were then selected by randomly choosing 2 downloads with data from each patient page (2 out of 25). These downloads were initially reviewed by a highly specialised, IBHRE CCDS accredited cardiac physiologist. Any downloads for which the Focus On™ interpretation accuracy was queried were then anonymised and forwarded to 3 CRM and EP consultants, who were blinded to the audit, for analysis. These analyses were collated and discussed at a wider EP meeting, which involved 2 further EP consultants and EP/CRM physiologists, for a consensus opinion.

Results: Of the downloads reviewed, the accuracy of 17 interpretations (3.4%) were disputed by a consensus opinion from consultants and physiologists. A total of 12 of the 17 EGMs showed atrial tachycardia and/or fibrillation, which had been interpreted as sinus rhythm with ectopy; 3 showed junctional rhythm (1 with short sinus arrest), interpreted as sinus bradycardia; 1 showed second degree AV block Mobitz type I, interpreted as sinus bradycardia; 1 showed second-degree AV block type II, interpreted as second-degree AV block type I.

Conclusion: The findings of this audit show that the percentage of patients with an abnormal trace among the Green alerts is not inconsequential and can have a bearing on optimal patient management. NHS Trusts already using such services or planning on using this service in future should consider performing their own audit or have mechanisms in place to do so when the service is up and running, to ensure quality of patient care is maintained. □



Table 1: Demographics and complication rate of implantable cardiac monitor insertions in different hospital settings

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Data presented as rate (number of patients) unless specified.

* = $p < 0.05$, IQR = interquartile range.

	Ward	Cath lab	Outpatients	Overall	P-value
Total	12.8% (84)	13.5% (89)	73.7% (484)	657	
Median age – years (IQR)	70 (63–76)	52 (34–68)	58 (43–69)	60 (43–71)	$<0.001^*$
Female sex	23.8% (20)	44.9% (40)	47.5% (230)	44.1% (290)	$<0.001^*$
White ethnicity	75.0% (63)	61.8% (55)	60.1% (291)	62.3% (409)	0.009^*
Anti-coagulant/platelet	52.4% (44)	36.0% (32)	40.5% (196)	41.4% (272)	0.07
Any complication	1.2% (1)	2.2% (2)	0.6% (3)	0.9% (6)	
Bleeding	1.2% (1)	2.2% (2)	0.2% (1)	0.6% (4)	
Infection	0.0% (0)	0.0% (0)	0.2% (1)	0.2% (1)	
Erosion	0.0% (0)	0.0% (0)	0.2% (1)	0.2% (1)	

Data presented as rate (number of patients) unless specified.

* = $p < 0.05$, IQR = interquartile range.



Oral Abstracts 1 – Allied and Service Development

10/The NUH Allied Health Professional Elective Implantable Loop Recorder Service. The Five-year Experience

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr10

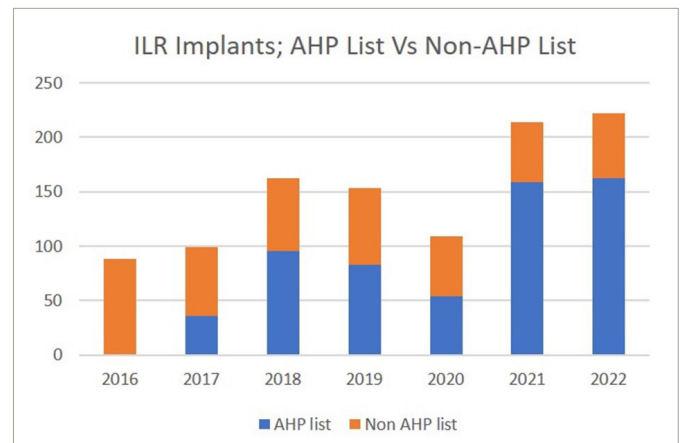
Authors: *S Wildish (Presenting Author) - Trent Cardiac Centre, Nottingham City Hospital, Nottingham, UK; R Terrington - Trent Cardiac Centre, Nottingham City Hospital, Nottingham, UK; T Robinson - Trent Cardiac Centre, Nottingham City Hospital, Nottingham, UK*

Background: Implantable loop recorders (ILRs) were traditionally inserted in the cardiac catheter lab on a consultant-led list. The most modern generation of devices (e.g. Medtronic LINQ II) are designed to be injected subcutaneously. The relative simplicity of the procedure brings it within the skillset of Allied Health Professionals (AHPs), freeing up medical staff, available cath lab time and increases revenue. Nottingham University Hospitals NHS Trust (NUH) setup the AHP ILR service in September 2017 with two AHPs, and currently operates with four as the demand for the elective service has grown, having more than quadrupled in 5 years.

Method: The setup of the AHP service involved training one cath lab practitioner and one cardiac physiologist under consultant supervision. After initial training, the lists were performed independently with a consultant available if necessary. As the demand for the ILR service has grown, the team has had a total of 9 AHP staff trained as implanters throughout the 5 years, and currently consists of two cath lab nurses and two cardiac physiologists. Each elective list typically runs with two trained members of staff. Patients no longer receive a preadmission, nor are antiplatelets/anticoagulation routinely stopped. The patients are ambulatory, not fasted and do not receive antibiotics for the procedure. Most patients are discharged within one hour of their scheduled appointment time.

Results: Since 2016, NUH have implanted 1,008 ILR devices, with 62% of these on elective AHP lists. In that time, we have recorded 9 device infections – 0.89% complication rate (0.47% AHP list versus 1.5% non-AHP list; Fisher's exact $P=0.59$) and 6 device erosions – 0.59% complication rate (0.79% AHP list versus 0.26% non-AHP list Fisher's exact $P=0.42$). Elective AHP lists currently account for 75% of ILRs implanted in NUH.

Figure 1: ILR implants: AHP list versus non-AHP list



The AHP staff currently perform 70% of inpatient ILR procedures. 23% of people who had an ILR went on to have a further procedure, such as a pacemaker or catheter ablation based on findings from the ILR. The skill of the implanters means that 3 of the AHP staff have been trained autonomously by existing AHP implanters without the need for consultant input.

Implications: The AHP loop recorder implant service is safe and cost effective. Implant volume is increasing. We are now able to train further AHP implanters independent of consultant supervision to meet the increased demand on the service. □

Oral Abstracts 1 – Allied and Service Development

11/Detection performance of three insertable cardiac monitors in a single centre

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr11

Authors: [R Macdonald](#) (Presenting Author) - Worcestershire Acute NHS Trust, Worcester, UK

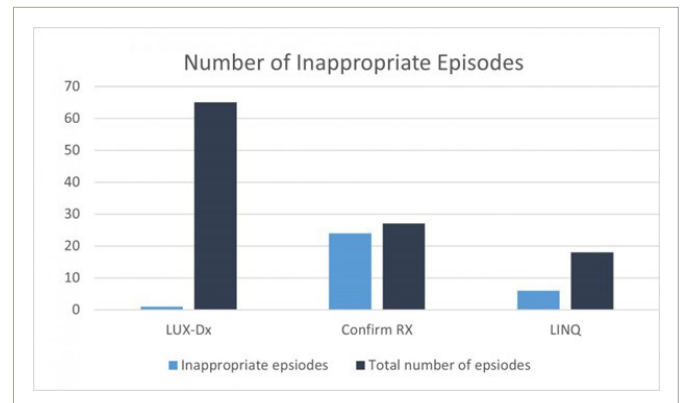
Background: Several insertable cardiac monitors (ICMs) are available to enable the diagnosis and monitoring of arrhythmias. Clinicians are faced with different ICM options and must balance the workload associated with episode review alongside device performance and ensuring receipt of clinically actionable data.

Objective: To compare in-time physician-adjudicated performance and clinical actionability of ICMs from different manufacturers that are currently in use at a single-centre.

Methods: This is a retrospective analysis assessing the percentage of appropriate and inappropriate device-triggered episodes from three different ICMs (LUX-Dx, Boston Scientific; Confirm-Rx, Abbott; LINQ, Medtronic). Patients with an ICM were randomly selected from a 6-month period at a single centre (Worcestershire Acute NHS Trust, UK) and were matched using the reasons for monitoring of palpitations or syncope. Episodes were adjudicated at the time of alert by the reviewing physician. Remote reprogramming rates and clinical actions taken in response to the data are also described.

Results: Data from 30 patients were included and equally distributed among the 3 devices (n=10 LUX-Dx; n=10 Confirm-Rx; n=10 LINQ). Within each group, 2 individuals were followed for palpitations and the other 8 were followed for syncope. Over the 6-month timeframe, 65 episodes were assessed for LUX-Dx, 64 (98%) of these were 'appropriate' and only 1 was 'inappropriate.' These data supported clinical actions for 50% of the patients which included an EP study, SVT ablation, PPM referral

Figure 1: Number of inappropriate episodes



(n=2), and CRT-P implant. Twenty-seven episodes from Confirm-Rx were assessed, 3 (11%) were 'appropriate,' 24 were 'inappropriate,' and one patient was referred for PPM. Eighteen episodes from LINQ were assessed, 12(67%) were 'appropriate,' 6 were 'inappropriate' and one patient received a PPM.

Conclusions: Although the LUX-Dx ICM had the highest number of episodes to review, it also had the highest percentage of appropriate episodes and the most clinically actionable data. □



Oral Abstracts 1 – Allied and Service Development

12/Upgrading to CRT at the time of EUR - A single-centre retrospective study to evaluate the implementation of a specialist clinic to assess patients for cardiac resynchronization therapy (CRT) devices at the time of elective unit replacement (EUR)

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr12

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Introduction: Right ventricular (RV) pacing, which is the standard treatment for patients with bradycardia, results in a broad QRS complex with dyssynchronous left ventricular contraction. Long-term RV pacing is associated with adverse remodelling of the left ventricular, which can contribute to, or cause, left ventricular (LV) systolic dysfunction, and heart failure (HF). A specialist clinic for patients with pacemakers approaching elective replacement indicator (ERI) and high RV pacing burden has been established. The patients were referred if RV pacing percentage > 40% and 12–18 months left on the battery. The clinic was run by a consultant, along with highly specialised cardiac physiologists. As well as the usual pacing checks, a full clinical assessment was carried out, along with a medication review and 12 lead ECG. Referral to echocardiography was made if no recent echo was available.

Methods: This retrospective audit followed 75 patients with pacemakers who were referred to the upgrade clinic between January 2022 and December 2022. The patient health records were reviewed to collect specific information on the patient, such as patient ID, age, sex, pacing system (VR/DR), RV lead location (RVA or RVS), RV pacing percentage, QRS width with pacing, underlying rhythm, aetiology, AF burden percentage, NYHA class, LV ejection fraction, upgrade to CRT device within one year of EUR.

Results: Of the 75 patients, 17 were recommended for CRT upgrade at the time of EUR. Of the 17 patients in the CRT upgrade group, 88% were male; mean age was 82 ± 8 years, mean QRS width 176 ± 17 msec, mean LV ejection fraction (LVEF) was $38 \pm 9\%$, classed as NYHA II were 35% and NYHA III were 53%. 76% of the patients in CRT upgrade group had persistent AF, $P=0.04$. Of the 58 patients in the standard EUR group, 65%

were male; mean age was 79 ± 11 years, mean QRS width 163 ± 19 msec, mean LV ejection fraction (LVEF) was $52 \pm 7\%$; classed as NYHA I were 47%, NYHA II were 43% and NYHA III were 10%. Patients were not just assessed for CRT upgrade, 18% had medications optimized and 14% had device settings changed to minimize RV pacing when possible. There is no significant difference in patients with single or dual chamber systems between the two groups ($P=0.77$); combining this with the AF data suggests that a lot of the initial implants were for patients in sinus rhythm who have subsequently deteriorated to AF and no difference in RV lead position between groups ($P=0.18$). There was a significant difference in paced QRS width ($P=0.03$), LV ejection fraction ($P<0.01$) and in NYHA class between the groups ($P<0.01$). Of the 17 patients recommended for CRT-P upgrade, 2 patients had a failed LV lead placement (difficult CS anatomy and left sided SVC with dilated CS) and 2 patients were converted to standard EUR on the day of the procedure. There were 2 procedure related complications, both in the CRT-P upgrade group. One patient had a small haematoma (no drain required), and the other one had significant issues with phrenic nerve stimulation that eventually led to the LV lead being programmed off.

Conclusions: This retrospective audit has demonstrated that the time of EUR is a great opportunity to assess and optimize patient medical and device therapy, identifying patients with important LV systolic dysfunction but few symptoms. Implementing it has led to a significant increase in the number of CRT-P upgrades at EUR, with no upgrades within the following 12 months of standard EUR whilst there were 2 patients in the previous year who required CRT upgrade within 12 months of EUR. □



Oral Abstracts 1 – Arrhythmia Clinical

13/Impact of investigational, at-home, self-administered, intranasal etripamil on the need for additional medical intervention in patients with supraventricular tachycardia

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr13

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Objectives: Paroxysmal supraventricular tachycardia (PSVT) causes economic burden due to a frequent need for medical interventions and emergency department (ED) visits with substantial costs. The NODE-301 study evaluated the efficacy and safety of the novel, fast-acting, investigational intranasal calcium channel blocker etripamil for conversion of PSVT in an at-home setting. This analysis assessed the impact of etripamil on the need for additional medical intervention.

Methods: NODE-301 was an event-driven, randomized, double-blind, placebo-controlled study. During a PSVT episode, patients self-administered study drug intranasally outside a medical setting. In Part 1, 419 patients were randomized to etripamil 70 mg or placebo, and in Part 2 (RAPID), 692 patients were randomized to etripamil 70 mg or placebo with a repeat dose if symptoms persisted. In this prespecified, pooled analysis, the proportion of patients receiving medical intervention for PSVT after administering etripamil or placebo was examined.

Results: Demographics included mean age 54.8 years, 69.6% female, and mean 8.2 PSVT episodes in the prior year. Of patients in optional

second-dose arms in the efficacy population (n=155), 57 (79.2%) using placebo and 55 (66.3%) using etripamil took a second dose. Across randomized patients, 340 treated an episode with placebo (n=134) or etripamil (n=206). Thirty-four (25.4%) randomized to placebo and 30 (14.6%) randomized to etripamil received additional intervention (oral or intravenous medications) (P=0.013). Thirty (22.4%) on placebo and 28 (13.6%) on etripamil required an ED visit for an episode of PSVT (P=0.035). The most common adverse events were related to the nasal administration site. No serious adverse events were related to study drug. Safety and tolerability data were consistent with those observed in prior trials.

Conclusions: Etripamil, an investigational drug, reduced the need for medical intervention, including ED visits, for PSVT in NODE-301. These preliminary findings suggest that self-administered etripamil may lower the healthcare burden and costs in patients with PSVT. □

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Oral Abstracts 1 – Arrhythmia Clinical

14/Quantification of left atrial wall thickness by cardiac computed tomography in patients with and without atrial fibrillation: Impact of estimation method

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr14

Authors: *Johanna Tonko (Presenting Author) – University College London, London, UK; AL Lee – Kings College London, London, UK; JW Whitaker – Kings College London, London, UK*

Introduction: Contemporary imaging methods allow to assess structural alterations implicated in initiation and maintenance of AF. It is thought that left atrial wall thickness (LAWT) increases in the presence of AF and may further promote its perpetuation. Tissue thickness may also be important to the success and safety of AF ablation to create transmural lesions without causing collateral damage. Different methods for quantifying local LAWT exist. An understanding of quantitative differences between estimation methods is relevant if LAWT-guided ablation strategies are pursued.

Methods: Patients with AF and controls without AF but with clinical indication for cardiac CT were recruited. The study received a favourable opinion from a national REC (ref 15/LO/1803). Prospective, ECG gated CCTA were acquired and best diastolic sequence identified. Two separate segmentation pipelines and LAWT calculation methods were employed:

1. A semi-automated custom-made workflow using an eikonal-based calculation ("KCL"): CT images were segmented with custom-made Python scripts to extract LA myocardium based on Hounsfield unit and crop the mitral annulus with a sphere (Seg3D2). Pulmonary veins and LAA were cropped using CEMRG app. The LA body segmentations were used to generate tetrahedral meshes (CGAL) for identification and extraction of endocardial and epicardial surfaces (Meshtool). Using the cardiac arrhythmia research package (CARP), vertices on the epicardial surfaces were activated simultaneously with the wavefront having a constant isotropic conduction velocity of 1 mm/s. LAWT was then estimated as the wavefront arrival time at the endocardium.
2. An automated proprietary LAWT analyzing tool integrated in ADAS3DTM software (V2.11.1-beta.10): Following CT integration, endocardial and epicardial delineation is fully automated and

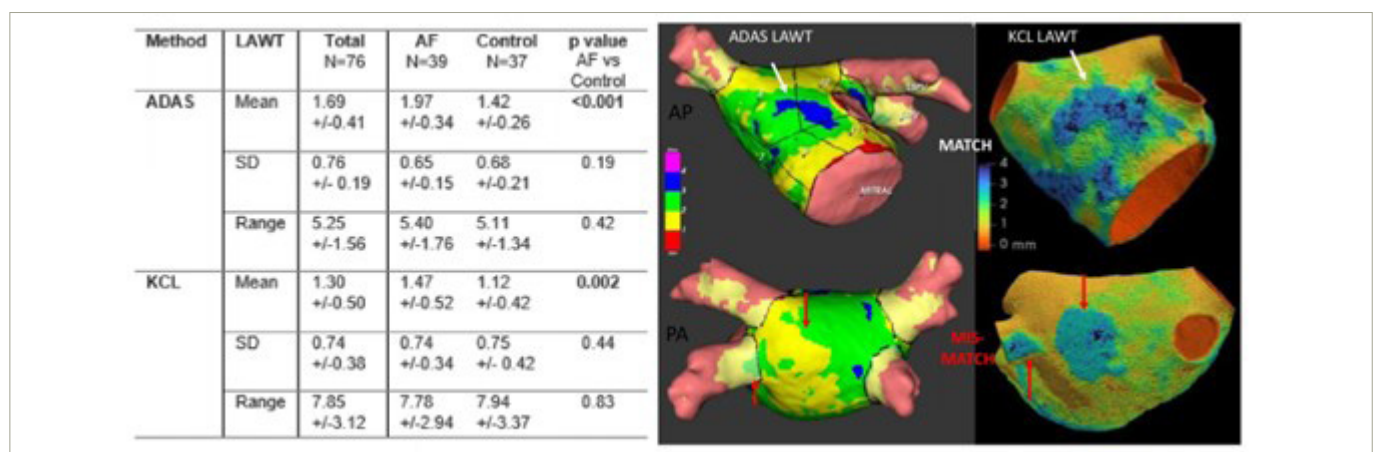
generates a 3D endo- and epicardial surface mesh, followed by manual review and adjustment of the model as appropriate. LAWT computation is based on the distance of each point on the endocardial surface of the corresponding closest point on the epicardial surface. PVs, LAA and mitral valves are cropped manually.

Results of mean \pm SD of LAWT of the LA body were compared between methods for the total population and separately for AF and control cohorts. Statistical significance was set at α 0.05.

Results: Forty-two patients with AF (64.3% male, age 64.6 ± 10.2 , CHA2DS2-VASc 2.48 ± 1.5 , 69.0% paroxysmal AF, 31% persistent AF, LVEF $57.9 \pm 10.5\%$) and 37 controls (64.9% male, age 56.6 ± 7.2 , CHA2DS2-VASc 1.54 ± 1 , LVEF $60.4 \pm 4.9\%$) were recruited. A total of 76 CTs (39 AF, 37 control,) were analyzed. Mean LAWT between the 2 methods showed moderate, statistically significant correlation (r 0.499, $p < 0.001$) and mean difference of 0.39 mm (p .001). LAWT was higher using ADAS3D in all groups (total, AF, control). Both methods identified a statistically significant increase in LAWT in patients with AF when compared to controls. There was no significant difference in standard deviation between estimation methods.

Conclusions: LAWT assessment using automated nearest point LAWT estimation or semi-automated eikonal-based estimation methods yield moderate, statistically significant correlation, with mean difference in the sub-millimetre range. Even though statistically significant, for clinical ablation procedures this difference is likely to be of negligible relevance. Local expertise and available software may determine the preferred approach for LAWT estimation. \square

Figure 1: LAWT (mm) mean, SD and range calculated by Adas3D and KCL method with exemplary 3D models



Oral Abstracts 1 – Arrhythmia Clinical

15/Efficacy of combining ranolazine with a class III anti-arrhythmic drug for maintaining sinus rhythm after DC cardioversion

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr15

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Background: Direct current electrical cardioversion (DCCV) is utilized for managing patients with symptomatic persistent atrial fibrillation (AF) as part of a rhythm-control strategy. Rates of acute conversion and maintenance of sinus rhythm (SR) following DCCV improve with concomitant use of anti-arrhythmic drugs (AAD) such as amiodarone, which has the greatest efficacy amongst various agents, albeit with a considerable side-effect profile. Ranolazine, primarily used as an anti-anginal, has demonstrated value as an effective AAD in AF and works synergistically with class III agents. This audit aimed to evaluate freedom from persistent AF at 1 year following DCCV in patients treated with a class III AAD, ranolazine or a combination of the two.

Methods: DCCV lists between June 2020 and February 2022 at a single tertiary cardiology centre were reviewed retrospectively. Patients undergoing DCCV on treatment with either a class III AAD (amiodarone or dronedarone), ranolazine (dosage range: 375–750 mg BD) or a combination of the two, and with a documented 1-year (range: 9–15 months) follow-up were included. Patients who underwent AF ablation during the follow-up period having maintained SR up to that point were excluded. Acute DCCV success and maintenance of SR at 1-year follow-up were recorded.

Results: Patient characteristics: 350 patients underwent DCCV during the study period, of whom 102 (29.1%) were on an anti-arrhythmic drug. After exclusions, 78 patients (mean age 67 ± 11.8 years, 82.3% male) were included. Baseline characteristics for patients in the treatment groups were as follows:

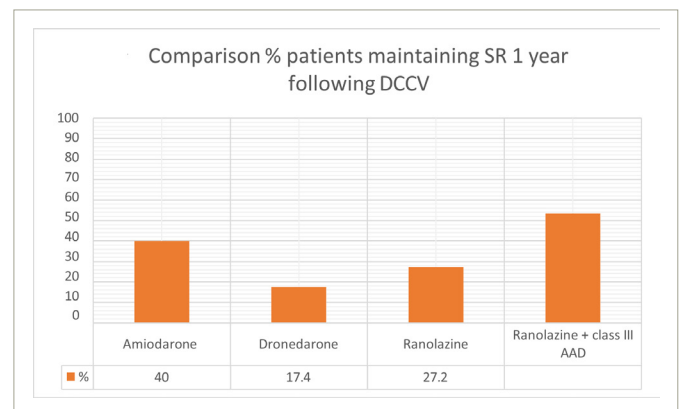
- amiodarone monotherapy: $n=30$, 65 ± 14.5 years, 83.3% male
- dronedarone monotherapy: $n=23$, 71 ± 9.1 years, 87.0% male
- ranolazine monotherapy: $n=11$, 63 ± 12.2 years, 90.9% male
- ranolazine and class III AAD: $n=14$, 69 ± 8.3 years, 64.2% male

Acute outcome: the proportion of patients achieving SR acutely post-DCCV for the 4 groups was as follows:

- amiodarone monotherapy: 27/30 (90.0%)
- dronedarone monotherapy: 21/23 (91.3%)
- ranolazine monotherapy: 10/11 (90.9%)
- combined ranolazine and class III AAD: 14/14 (100%)

Outcome over 1-year follow-up (Figure 1): at 1-year follow-up (mean

Figure 1: Proportion of patients in sinus rhythm at 1-year follow-up post-direct current electrical cardioversion



follow-up 11 ± 1.9 months – similar for all 4 groups), the proportion of patients maintaining SR was as follows:

- amiodarone monotherapy: 12/30 (40.0%)
- dronedarone monotherapy: 4/23 (17.4%)
- ranolazine monotherapy: 3/11 (27.2%)
- combined ranolazine and class III AAD: 8/14 (53.3%)

Patients taking a combination of ranolazine and a class III AAD were numerically more likely to remain in SR at 1-year follow-up than those on amiodarone or ranolazine, but this was not significant for either ($P=0.34$ and $P=0.23$, respectively). However, combination therapy was significantly more effective than dronedarone monotherapy ($P=0.03$). There were no significant differences between the 3 monotherapies.

Conclusion: Combining ranolazine with a Class III AAD may improve maintenance of SR at 1 year following DCCV compared with Class III AAD monotherapy. Ranolazine monotherapy also shows comparable efficacy to traditional Class III agents and could therefore be considered as an alternative agent or as synergistic therapy. Larger randomized multi-centre trials are merited to assess the efficacy and safety of these treatment strategies. □



Oral Abstracts 1 – Arrhythmia Clinical

16/Persistent atrial fibrillation cryoballoon ablation, single UK centre experience (2015–2023)

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr16

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Introduction: Atrial fibrillation (AF) is the most common cardiac arrhythmia and the prevalence is increasing every year, especially for persistent atrial fibrillation. The evidence base for rhythm control strategies in persistent atrial fibrillation remains contentious. Cryoballoon ablation is one of the conventional rhythm-control therapies in treatment-resistant AF, and has emerged as a successful therapeutic option as it confers a beneficial effect on procedure time with low rates of reconnection in contrast to most radiofrequency pulmonary vein isolation series. However, there is little UK data to support its use as a first ablation strategy for persistent AF.

Aim: To assess the medium-term efficacy of cryoballoon ablation for persistent AF (1- and 2-year follow-up).

Method: Data extracted from persistent AF cryoballoon ablation database at University Hospitals Plymouth NHS Trust between January 2015 to December 2021 (all cases performed by Dr Guy Haywood). Demographic, echocardiographic and procedural data were collected, as were safety and freedom of AF recurrence at 1 year and 2 years. AF recurrence >30 seconds occurring beyond the 3-month blanking period was assessed by all clinical means available, including a patient reporting telephone line to arrhythmia care co-ordinators. Any ECG evidence of recurrence or documented high heart rate on pulse oximeter or phone app associated with typical symptoms was considered to be a treatment failure. Personal ECG recording devices, 24-hour tapes and pacemaker telemetry all contributed to clinical surveillance.

Results: Ninety-two sequential cases of cryoballoon ablation for persistent AF were included in the analysis, with a median age of 56 (range 30–82), BMI of 34 kg/m² (range 27–40) (moderately obese), LVEF of 50% (range 30–65) and median LA size 'moderate dilatation'. Analysis was done at 1- and 2-year time points. All 92 cases (100%) were acutely successful with 4 pulmonary vein isolation. Three patients had post procedure complications: 1 case of small pericardial effusion without drainage, 2 cases of right phrenic nerve injury, one with full recovery, one asymptomatic but persisting. Sixty-nine out of 92 (75%) of patients were free of AF recurrence at 1 year and 57/77 (74%) of patients were free of AF recurrence at 2 years. Of the 77 patients who completed 2 years, 4 patients who were free of AF recurrence at 1 year progressed to AF in the second year, which is 5%. Five out of 20 patients needed re-do procedures during year 2 (all counted as treatment failures). Of the 5 re-do cases, 4 were done at UHP and all 4 pulmonary veins were still isolated at re-do mapping. Overall efficacy of cryoablation in persistent AF at 2 years is probably best considered as 70%, given the second year drop off observed.

Conclusion: Cryoballoon pulmonary vein isolation for persistent AF remains a safe first-time ablation procedure with good clinical outcomes (freedom from AF recurrence 75% at one year and 70% at 2 years) in a typical UK population. □



Oral Abstracts 1 – Arrhythmia Clinical

17/A comparison of administration of ajmaline via intravenous injected boluses versus intravenous infusion in the diagnosis of Brugada syndrome

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr17

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Introduction: ECG changes diagnostic for Brugada syndrome may be precipitated by sodium channel blocker (SCB) challenge. The SCB ajmaline has been demonstrated to be an effective pharmacological agent of choice. Published studies recommend a dose of 1 mg/kg bodyweight (maximum 100 mg) given either as a continuous infusion or by repeated boluses at 10 mg/minute intervals. To our knowledge, there has been no comparison of these two administration methods. We aimed to compare the safety and efficacy of these two methods.

Methods: Retrospective comparison was undertaken of two cohorts undergoing SCB provocation with ajmaline in the United Kingdom: St. George's Hospital, London using continuous infusion (n=332), and Royal Papworth Hospital, Cambridge using repeated boluses (n=148). All patients received ajmaline at a dose of 10 mg/kg with a maximum dose of 100 mg. ECGs, including high right ventricular lead positions, were compared at baseline, before drug administration, and at maximum drug effect (defined as the ECG performed after the end of infusion/last bolus administered which showed either the highest J-point elevation in the context of a type 1 Brugada ECG pattern, or maximum QRS duration in the context of a negative test). The proportion of positive test results between the two groups was compared as an indicator of diagnostic yield. Any adverse events associated with the test were

documented for comparison of safety of the two administration methods. Since the likelihood of a positive test was highly dependent on the pre-test probability, the change in heart rate and QRS duration were also measured as these have been shown to increase similarly in positive and negative ajmaline provocation tests. Results were reported as proportional changes from baseline. Results are reported as mean \pm standard deviation. Continuous variables were compared with a student t-test. Categorical variables were compared with a chi-squared test.

Results: The infusion and bolus cohorts were similar in terms of age (39.4 ± 14.8 versus 42.0 ± 14.4 , $p=0.07$) and sex (56% male versus 44% male, $p=0.14$). There were no significant differences in the proportion of a positive test (38% versus 34%, $p=0.41$) between the two groups. The proportional increase in heart rate (13% versus 12%, $p=0.36$) and QRS duration (37% versus 26%, $p=0.07$) were also similar between the two groups. There were no adverse outcomes documented with either ajmaline administration method.

Conclusions: Ajmaline can be administered via continuous infusion or repeated boluses with similar safety and efficacy. Studies using both methods can be considered directly comparable. □



Oral Abstracts 1 – Arrhythmia Clinical

18/Implementing an end-to-end pathway for detection, diagnosis, and management of atrial fibrillation in the risk-stratified patients: Results from the Atrial Fibrillation Stroke Prevention Hub program

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr18

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Background: Atrial fibrillation (AF) is a prevalent cardiac arrhythmia linked with a five-fold increased risk of ischaemic stroke. Despite the need for pulse rhythm checks of reasonable duration in selectively identified high-risk patients, the NHS is under pressure to perform these tasks to prevent stroke during daily practice in primary care.

Purpose: This program aimed to establish an end-to-end pathway to identify, detect, diagnose, and manage high-risk patients with no prior AF diagnosis.

Methods: The AF Stroke Prevention Hub program was aimed at patients aged 65 and above with a history of heart failure or stroke/transient ischaemic attack. Data from electronic patient records identified these patients, while exclusion criteria consisted of known AF, implanted cardiac devices, end-stage renal disease, and end-of-life care. The program used a medically certified photoplethysmography (PPG) smartphone application to monitor the heart rate and rhythm and track symptoms using photoplethysmography. Patients were facilitated to perform two measurements per day for 7 days, and additional measurements if experiencing symptoms. Those who were digitally excluded were offered an assessment in a face-to-face clinic appointment. Based on the PPG recordings, patients with a positive finding received a confirmatory ECG examination and anticoagulation therapy, once the diagnosis was established, within 48 hours. Those with a negative result based on the PPG monitoring period received reassurance and advice.

Results: Between February 2022 and February 2023, after applying inclusion and exclusion criteria, 669 patients were found to be eligible,

from 4 primary care practices. Two hundred and sixty-seven patients were issued PPG applications after obtaining consent. In total, 210 patients completed the PPG-based, 7-day monitoring period. The technology adoption rate was 78.65% in this group of patients.

A total of 10 patients (6.5%) were detected with possible AF based on the PPG recordings. Six patients were diagnosed based on a confirmatory 12-lead ECG or a 7-day Holter. All patients with newly diagnosed AF (3.9%) received anticoagulation therapy and were managed accordingly, while the remaining patients received advice regarding self-management, lifestyle and yearly health checks.

Among the high-risk group of cardiac failure, 4 patients were detected with possible AF, based on the PPG recordings. All 4 were confirmed via a 12-lead ECG or a Holter monitor, with an AF detection rate of 9.09%. Combining all stratified risk patient cohorts, 10 (4.76%) were detected with possible AF based on the PPG recordings and 6 (2.8%) were verified based on a confirmatory 12-lead ECG or a 7-day Holter.

Conclusion: Compared with the current NHS opportunistic pulse check where the detection rate is <1%, the AF Stroke Prevention Hub program successfully identified patients with a significantly higher detection rate. The hub delivered an end-to-end pathway allowing real-time reporting and triaging of patients, early detection, appropriate confirmation and rapid treatment with favourable real-life technology adoption. Expanding the data-driven program to a wider difficult-to-reach population could reduce the burden on NHS and improve patient outcomes. □



Oral Abstracts 2 – High-scoring Abstracts

19/The safety and effectiveness of low molecular weight heparins for stroke prevention in atrial fibrillation: A systematic review

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr19

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Introduction: Atrial fibrillation (AF) increases the risk of stroke by up to five-fold and costs the UK economy £2 billion per year. Direct-acting oral anticoagulants (DOACs) or vitamin K antagonists (VKAs) are offered to eligible individuals to reduce their thromboembolic risk, yet are not suitable for all patients, for instance due to significant drug-drug interactions. Off-label use of subcutaneous low molecular weight heparins (LMWHs) may constitute an alternative option for stroke prevention in such patients. The aim of this systematic review was to ascertain whether or not the monotherapy of existing LMWHs was as safe and effective in the prevention of stroke in adult patients with AF compared to DOACs or VKAs.

Methods: The study was conducted in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (protocol reference: CRD42022378257). Literature searches were carried out on MEDLINE and Embase in November 2022. Longitudinal studies reported in English were included if they investigated the safety and/or effectiveness of LMWHs compared to DOACs or VKAs for the prevention of stroke in participants with AF aged ≥ 18 years. Study characteristics and clinical outcomes (risk of stroke/transient ischaemic attack [TIA]/systemic embolic events [SEEs], all-cause mortality and major bleeding) were extracted and analysed in Microsoft Excel using descriptive statistics. Study quality was assessed using the Newcastle-Ottawa scale for observational studies.

Results: Seven eligible studies involving 3,145 participants (3 prospective cohorts; 49.6% female) were included in the review. Of these studies,

3/7 involved patients with active cancer, and 1/7 involved either patients with a COVID-19 infection, those receiving haemodialysis, older persons or stroke survivors, respectively. A total of 790/3,145 (25.1%) participants were given LMWH monotherapy (506/790 [64.1%] were prescribed a therapeutic dose). Stroke/TIA/SEEs were an outcome in 5/7 studies, whereas major bleeding and all-cause mortality were reported by 7/7 and 3/7 manuscripts, respectively. In patients with active cancer, LMWHs were associated with a seven-fold greater risk of stroke/SEEs compared to DOACs. LMWH were also associated with a two-fold increased risk of recurrent strokes/TIAs and major bleeding compared to DOACs or VKAs post-acute stroke. There was a non-significant trend towards increased risk of bleeding with LMWH compared to DOACs or VKAs in all other studies. One study reported a 1.5-fold greater mortality amongst active cancer patients prescribed LMWH compared to those receiving DOACs.

Conclusions/Implications: Data presented here does not support routine use of LMWH for stroke prevention AF, however are limited by heterogeneity of studies retrieved. LMWHs were associated with increased risk of major bleeding compared to either DOACs or VKAs, although this trend was only significant in stroke survivors. Several studies highlighted the inferiority of LMWH monotherapy compared to oral anticoagulants with regards to stroke/TIA/SEEs and all-cause mortality outcomes. Future studies should consider exploring the effects of varying LMWH doses on clinical outcomes in AF, particularly amongst specific population groups that may benefit from them as an alternative option. □



Oral Abstracts 2 – High-scoring Abstracts

20/Response to cardiac resynchronization therapy in patients with atrial fibrillation versus sinus rhythm: A single UK centre study

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr20

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Introduction: Cardiac resynchronization therapy (CRT) is widely used for the management of patients with heart failure (HF) and severe left ventricular (LV) systolic dysfunction with a wide QRS duration.¹ However, there is currently limited evidence on its effectiveness in patients with atrial fibrillation (AF). The purpose of this study is to investigate response to CRT in patients with AF compared to sinus rhythm (SR) in a large UK cohort.

Methods: This was a single-centre retrospective observational study of patients receiving CRT-P/D/upgrade between 2016 to 2020. Demographic characteristics, ECG parameters, biventricular pacing (BiV) percentage, and referral for AV node ablation (AVNA) were extracted from electronic patient records. The primary outcome was all-cause mortality and change in NYHA class at 1-month post-procedure. Outcomes were compared between patients in SR, AF not referred for AVNA, and those referred upfront for CRT and AVNA strategy.

Results: A total of 1,072 patients were included. Average follow-up was 32.1 ± 13.6 months. A total of 576 patients (53.7%) had AF and 129 (22.4%) patients were referred for initial CRT and AVNA strategy. A further 29 patients had subsequent AVNA over the course of the study. Mean time between implant and ablation was 247.0 ± 374.0 days. Patients with AF without referral for AVNA were significantly older ($p < 0.001$) and had more co-morbidities than those in SR. QRS duration was similar

($p = 0.551$). Patients with AF with AVNA referral were younger ($p = 0.015$) and had fewer co-morbidities than those with AF without AVNA referral. QRS duration was lower ($p < 0.001$), and ejection fraction was greater ($p = 0.022$). After CRT, mean BiV% 1-month post-implant for AF was 81.3% versus 87.5% in SR. Mortality was greatest in patients with AF without referral for AVNA (25.3%), compared with 9.1% for those who had SR and 14% with initial referral for AVNA ($p < 0.001$). Mean change in NYHA Class 1-month post-implant was greatest in patients with AF referred for AVNA (-0.41) versus those with AF not referred for AVNA (-0.28) and those who had SR (-0.34) ($p = 0.006$). A significant survival benefit was observed in SR patients with LBBB versus non-LBBB (OR: 0.36, 95% CI [0.18–0.72], $p = 0.003$). This association was not seen in patients who had AF (OR: 1.08, 95% CI [0.68–1.74], $p = 0.737$).

Conclusion: Patients referred for CRT who were (1) in SR and (2) initially referred for AVNA had substantially reduced mortality than those patients with AF referred for CRT without initial AVNA. This may be driven by the underlying HF syndrome and co-morbidities of these different groups. The effect of LBBB on outcome was only present in those patients in SR. Careful consideration should be given as to whether patients with AF should be referred for CRT who otherwise fulfil recommended guidance for CRT. □

1. Glikson M, Nielsen JC, Kronborg MB, et al. 2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy. *Eur Heart J*. 2021;42:3427–520.



Oral Abstracts 2 – High-scoring Abstracts

21/Multi-disciplinary ventricular tachycardia clinic: A rounded approach to VT management

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr21

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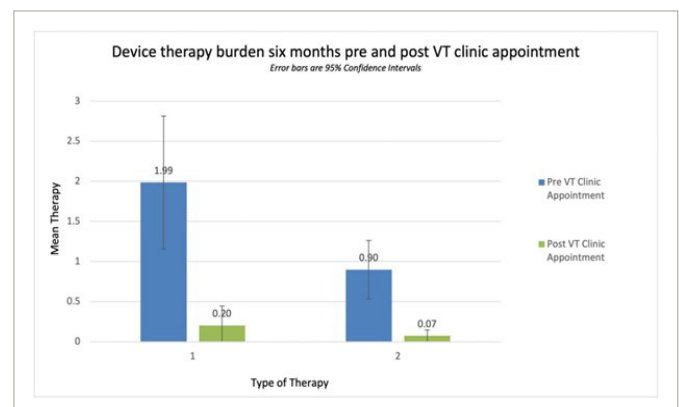
Introduction: Ventricular tachycardia (VT) is a potentially life-threatening arrhythmia that can be caused by many factors, such as the patients' underlying cardiac condition and importantly the cardiac scar. However, initiation of VT can be multi-factorial, and be associated with other factors, such as lifestyle, glycaemic control and respiratory disease. An implantable cardioverter defibrillator (ICD) is used to treat VT, and medical therapy is utilised to reduce the burden of VT. We established a multi-disciplinary (MDT) VT clinic in 2018 and proved a reduction of ICD therapy for VT. Following the appointment of a new consultant supervising VT clinic, we aimed to re-evaluate the effect on the clinic. Comparing the total device burden of therapies delivered 6 months before the VT clinic appointment and 6 months after the initial clinic appointment.

Methods: A retrospective service evaluation was conducted at a tertiary cardiac centre between April 2021 and April 2022. The population included all new patients over the age of 18 who were managed under the new VT clinic supervision between April 2021 and April 2022.

Results: Within the study cohort of 69 patients, shocks pre- and post-clinic demonstrated an odds ratio of 18.79 (95% CI 6.31 to 51.49, $p < 0.0001$) and anti-tachycardia pacing pre- and post-clinic shows an odds ratio of 17.37 (95% CI 6.43 to 44.03, $p < 0.0001$).

Medical management device optimization was the most common therapy occurring in 75% of patients, with 4% being referred for VT ablation and 17% having no changes in their management. Anti-arrhythmic medication, beta blockers or class III antiarrhythmic, up-titration was performed in 45% of patients. Device optimization performed in 29%. Initiation of Class III antiarrhythmic was performed in 6% of patients. Heart failure medical optimization or drug initiation (ACE inhibitor, ARB, MRA, SGLT2i or Entresto) was performed in 13%. Referral to advanced heart failure care or to specialist cardiomyopathy EP was the outcome for 7%. Twenty-nine per cent of patients had more than one clinic outcome.

Figure 1: Bar graph showing the significant reduction of ATP and shock therapy pre- and post-VT clinic ($p < 0.0001$)



Regarding the patient-pathway timeline, 48% of patients were seen in clinic between 1–15 days, the remaining 36 patients were seen between 16 to 120 days, with a mean of 27 days.

Conclusion: The service evaluation demonstrated a significant reduction in ICD therapy burden, with medical management and device optimization being the most common clinical outcomes. The use of other methodologies is likely to have contributed to the patient's overall health and likely been a factor in the large reduction of VT burden across the cohort. The results indicate that holistic approaches can significantly reduce the burden of VT, utilising an individualised care plan. Further investigation into the patient-reported outcome measures from this clinic of VT can build to the developing evidence for management of patients with VT. □



Oral Abstracts 2 – High-scoring Abstracts

22/Management of patients following ICD therapy: The importance of a multifaceted approach

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr22

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Background: In patients presenting following a first implantable cardioverter defibrillator (ICD) therapy, the risk of a subsequent ICD therapy is elevated. The most effective way to treat these patients is unknown. We hypothesised that in patients presenting following their first ICD therapy, a multifaceted approach combining treatment strategies would lead to a reduction in the risk of subsequent therapy compared to using single strategies alone.

Methods: We included consecutive patients undergoing ICD implantation between 2009 and 2019 at King's College Hospital, London who had experienced their first ICD therapy. We assessed the use of 7 specific treatment strategies (starting/increasing betablockers, starting/increasing non-betablocker prognostic heart failure medications, starting/increasing antiarrhythmic drugs, ICD reprogramming, ablation, ICD lead upgrade/revision and coronary revascularization) introduced after the first ICD therapy. We evaluated the association between the introduction of these treatment strategies and the risk of a subsequent ICD therapy during follow-up.

Results: We assessed 1,003 new ICD recipients; during a mean follow-up of $1,519 \pm 1,055$ days, 267 experienced a first ICD therapy (212 appropriate and 55 inappropriate) and were included in the analysis. During a mean follow-up of $1,126 \pm 1,103$ days following the first

appropriate therapy, 113/212 patients had a subsequent appropriate ICD therapy, of which 66 had an appropriate shock. Compared to patients where 0/7 treatment strategies were used ($n=59$), patients where 1/7 treatment strategy was introduced ($n=80$) had a 42% lower risk of a subsequent appropriate therapy and $\geq 2/7$ treatment strategies ($n=73$) was associated with a 57% reduction ($p=0.002$).

During a mean follow-up of $1,340 \pm 1,305$ days following a first inappropriate therapy, 18/55 patients had a subsequent inappropriate ICD therapy, of which 15 had an inappropriate shock. Compared to patients where 0/7 treatment strategies were used ($n=8$), patients where 1 treatment strategy was introduced ($n=22$) had an 86% lower risk of a subsequent inappropriate therapy and $\geq 2/7$ treatment strategies ($n=25$) was associated with a 94% reduction in the risk of a subsequent inappropriate therapy ($p<0.001$).

These associations remained significant when adjusted for baseline variables.

Conclusions: For both appropriate and inappropriate therapy, the risk of a subsequent ICD therapy is significantly elevated following the first therapy. A multifaceted approach combining treatment strategies may be more effective than the use of individual strategies alone to prevent subsequent therapy in patients presenting following a first ICD therapy. □



Oral Abstracts 2 – High-scoring Abstracts

23/AI-ECG-derived body mass index: A novel marker of cardiometabolic health

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Background: Obesity-related cardiac remodelling may be reflected through electrocardiogram (ECG) changes. Based on this premise, we hypothesised that an artificial intelligence (AI)-ECG model could be trained to predict body mass index (BMI), and that the difference between AI-ECG predicted BMI and measured BMI (delta BMI) would be a marker of cardiometabolic health. Additionally, we sought to understand the underlying biological mechanisms contributing to the AI-ECG-derived delta BMI.

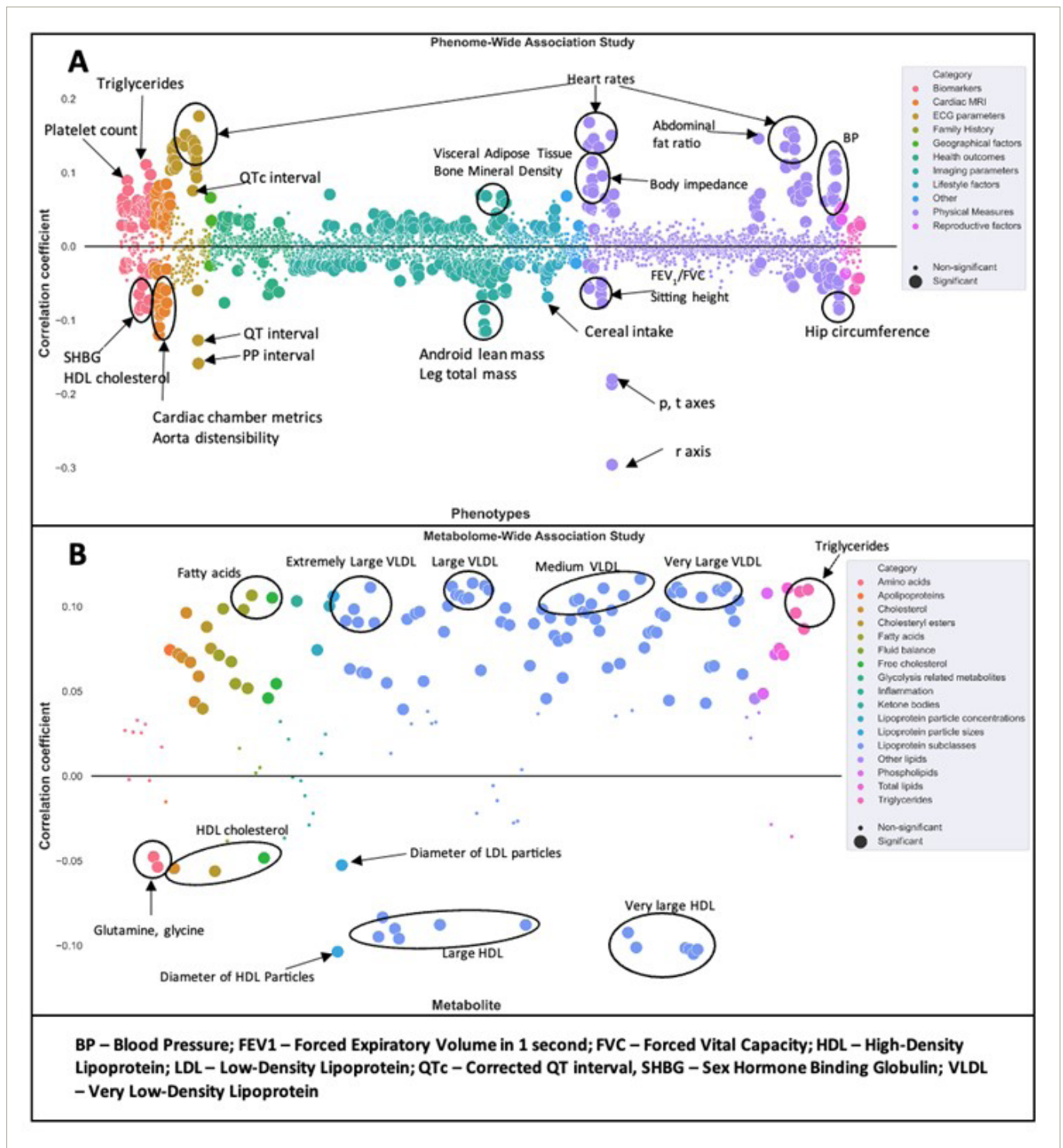
Methods and results: We developed an AI-ECG model using a cohort of 512,950 ECGs from 114,415 patients from Beth Israel Hospital Deaconess Medical Center in Boston to predict their BMI. The model's mean absolute error was 4.09 (95% CI: 4.03–4.12) and the model's correlation coefficient was 0.64. The model was externally validated using the UK Biobank (UKB) 12-lead ECGs from 42,386 patients. The mean absolute error was 3.92 (95% CI: 3.87–3.97) and the correlation coefficient was 0.61. Using the delta BMI values for the UKB cohort corrected for measured BMI, age, and sex, we performed Cox regression and a phenome-wide association study (PheWAS). A unit increase in the standard deviation of delta BMI was associated with an 18% increase in the risk of future hypertension (HR 1.18, 95%

CI: 1.12–1.24). A PheWAS against 3,145 phenotypes revealed significant positive associations with heart rate, blood pressure, QTc interval, blood biomarkers (triglycerides, platelet count), visceral adiposity, abdominal fat ratio, and body impedance, and negative associations with cardiac chamber volumes, android lean mass and hip circumference. (Figure 1A) A metabolome-wide association study revealed significant positive associations with fatty acids, VLDL particles, and triglycerides, and negative associations with HDL particles, glutamine, and glycine (Figure 1B). A genome-wide association study of the adjusted delta BMI identified nearly significant associations with DNAH10 and CCDC92, both of which have putative roles in adipogenesis.

Conclusion: Our study demonstrates that an AI-ECG model can accurately predict body mass index. The model achieved very good performance and was successfully validated using the UK Biobank cohort. The AI-ECG-derived delta BMI captures significant associations with future hypertension, cardiac and metabolic phenotypes, and biologically plausible metabolites that are additive to measured BMI, as well as nearly significant associations with genes linked to adipogenesis. AI-ECG-derived delta BMI may be used to identify subjects at increased risk of cardiometabolic disease. □



Figure 1: Pacing threshold vs referenced local impedance in Stablepoint patients





Oral Abstracts 2 – High-scoring Abstracts

24/Detecting deceased patients on cardiac device remote monitoring: A case series and management guide for cardiac device services

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr24

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Introduction: The increasing use of remote monitoring (RM) for implantable cardiac devices presents challenges for device services in managing the volume and nature of information received. Detecting a patient's death through RM transmissions is a significant but infrequent event. This study aims to describe the characteristics of alert transmissions indicating the possibility of death and propose a management strategy for such scenarios.

Methods: The study included consecutive ambulatory out-patients whose deaths were initially detected through remote monitoring. Clinical and device data were collected from electronic records, the hospital's device database, and the RM platform. Ethical approval was obtained from the institution's Clinical Effectiveness Unit.

Results: Over a 9-year period (2014–2023), 28 deceased patients were detected. The mean age of patients was 72 ± 11 years, and the mean left ventricular ejection fraction was $34 \pm 14\%$. Of the deceased patients, 21 had implantable cardioverter-defibrillators (ICDs), 4 had pacemakers, and 3 had implantable loop recorders. In 54% of the cases, the patient's death was already known, while in the remaining cases, family members were unaware or could not be contacted. Alert transmissions indicating death were commonly related to ventricular tachycardia (VT) or ventricular fibrillation (VF) events, but also due to right ventricular lead integrity, right atrial sensing amplitude, or implantable loop recorder device status. Several diagnostic features in transmissions may indicate a patient's death. The most reliable diagnostic feature is the presenting electrogram (EGM) transmission, which shows pacing at the

lower rate limit with no evoked response or local capture and no T waves across any channel. Device diagnostics and lead parameters, such as an increase in intracardiac impedance, can also suggest a deceased patient. Arrhythmia events recorded by the device, especially exhausted therapies or agonal rhythms, may indicate death, although not all cases present with EGM recordings. However, these observations may not always be conclusive, as device-related factors or fractures can mimic the features of a deceased patient. Among the deceased patients, the majority had VT or VF at the time of death. In cases where ICD shocks were delivered, the arrhythmia re-initiated shortly after successful cardioversion. Delayed therapy was observed in some patients due to slow VT progressing to VF or functional under sensing. Some patients did not receive ICD shocks due to inappropriate withholding of therapy by SVT discriminators or because the VF rate fell below the programmed shock therapy zone.

Conclusion: The detection of patient deaths through RM of implantable cardiac devices presents unique challenges and considerations for device services. This study highlights the key features indicating likely death in RM transmissions, including presenting EGM, device diagnostics, and arrhythmia events. It also emphasizes the need for improved device programming and response protocols to ensure timely and appropriate therapy delivery. Standard operational policies and legal consultation should be established to address the implications of RM in detecting patient deaths. □

Oral Abstracts 2 – Arrhythmia Mechanisms/*In Silico* Tools

25/Reduction in exercise-induced oscillatory ventilation after catheter ablation in patients with atrial fibrillation with systolic heart failure

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr25

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Background: Periodic breathing pattern is a poor prognostic factor of advanced systolic heart failure (HF). It can manifest as exercise-induced oscillatory ventilation (EOV) on cardio-pulmonary exercise testing (CPET); a result of impaired homeostasis. Atrial fibrillation (AF) is also associated with exertional dyspnoea and EOV has not been described in patients with AF and HF.

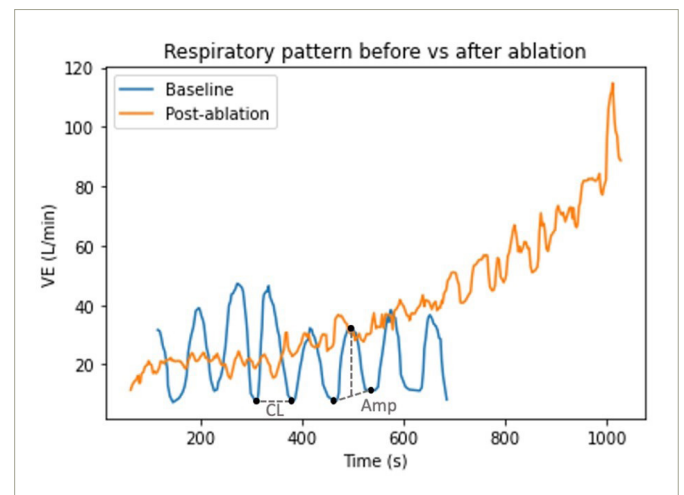
Objective: To report the prevalence and characteristics of EOV in patients with AF and HF, and the impact of catheter ablation (CA).

Methods: Patients with persistent AF and HF undergoing first-time CA underwent CPET at baseline and 6 months after restoration of sinus rhythm as part of enrolment in the AFHF study (ClinicalTrials.gov identifier: NCT04987723) between January to December 2022. CPET was performed on a semi-recumbent cycle ergometer with minute ventilation, oxygen saturation and carbon dioxide production monitored throughout. A 3-minute warm-up was followed by exercise with the work rate incremented by 10–20 Watts/minute till exhaustion, aiming for 8–10 minutes of exercise and a respiratory exchange ratio of >1.0. EOV pattern was quantified as the average amplitude of oscillation in minute ventilation (Ve) and the percentage duration of oscillatory breathing pattern relative to the total test period (EOV fraction). PROMs were evaluated through contemporaneous completion of the Atrial Fibrillation effect on Quality of Life (AFFeQT) questionnaire (rescaled to /100). Paired statistical testing (paired Student's t-test for parametric and Wilcoxon signed-rank test for non-parametric variables) will be used to compare changes over time.

Results: Of the 17 patients who completed follow-up within the study duration, the mean age was 62 ± 10 years and the average BMI was 30.8 ± 6.2 kg/m², with 14 (82%) of the cohort male. Significant improvements were seen in peak VO₂ ($1,473 \pm 640$ mL versus $1,780 \pm 590$ mL, $p=0.02$).

EOV phenomenon was observed in 16 out of the 17 patients (94%) at baseline with an oscillatory amplitude of 10.0 L/min (7.5, 12.2) and a cycle length of 30.2 seconds (23.3, 37.5). Post-ablation, the EOV fraction reduced significantly in 15 (94%) patients (15% [5, 19] versus 6%

Figure 1: Respiratory pattern before versus after ablation



Dynamic change in minute ventilation (Ve) over duration of cardiopulmonary exercise test in an example patient at baseline and repeated 6 months after AF catheter ablation. Dashed lines demonstrate how oscillation cycle length (CL) is measured as the time between consecutive nadirs and oscillation amplitude (Amp) as the mean of two consecutive nadirs subtracted from their interval peak Ve.

[4, 12], $p=0.01$). The oscillatory amplitude (6.9 L/min [4.4, 9.1], $p=0.02$) and cycle length (25.0 s [18.0, 30.0], $p=0.02$) also decreased significantly. In line, the symptom severity score improved significantly (47 [28,61] versus 94 [85, 96] $p=0.03$).

Conclusion: EOV is commonly observed in patients with AF and HF, but significantly improves after CA. This suggests a dynamic nature of the underlying mechanism with potential pathway remodelling in this patient cohort when sinus rhythm is restored. Further research is warranted to better elucidate the relationship between EOV and exertional dyspnoea. □



Oral Abstracts 2 – Arrhythmia Mechanisms/*In Silico* Tools

26/A proof-of-concept in-silico test bench for substrate-based ablations in persistent atrial fibrillation

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Background: Improving outcomes with ablation of non-paroxysmal AF has proved challenging because of large interindividual variability in the underlying electrical and anatomical substrate. Computational models personalized to patient electroanatomic mapping (EAM) data can provide an inexpensive technology to predict outcomes for non-PV ablation strategies in terms of success, failure or reduced AF complexity on a patient-specific basis. Performance of non-contact charge density mapping to guide ablation of non-PV targets in PsAF following either a first or second failed procedure was evaluated in a recent multicentre trial, RECOVER AF, and showed encouraging outcomes. This study aims to assess the predictive potential of LA computational models personalized to PsAF patient data for simulating the outcome of sequential ablation strategies outside of PV isolation.

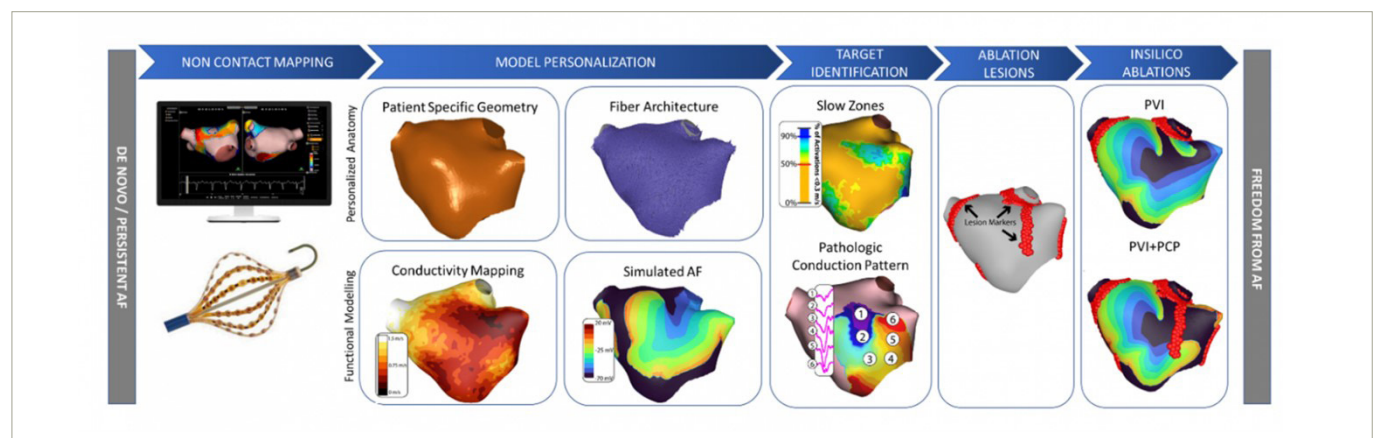
Model pipeline: EAM data from cases of an on-going observational, prospective, multicentre, multi-national, open-label registry (DISCOVER) were used. Electrophysiology models were personalized to patient anatomic and tissue conduction properties using electroanatomic recordings, shell geometry and histological observations of average fibre-direction in the left atrium. Tissue conduction properties and cellular level dynamics of the pathologic conduction areas

were modified based on activation times and conduction velocity heterogeneity obtained through Acutus AcQMap non-contact mapping catheter recordings. Three types (localized partial rotational activity [LPRA], localized irregular activity [LIA] and focal activity) of pathologic conduction pattern (PCP) targets as identified through the non-contact AcQTrack system were simulated to model pathologic propagation using openCARP electrophysiology simulator. Simulations of personalized model were used to assess the effect of PVI, PCP and PVI+PCP ablation lesions in comparison to the baseline AF case.

Results: Personalized model provided a proof-of-concept in silico EAM test bench to predict wave behaviour through a comparison of AF complexity with PVI (marginal or no change) to PVI + PCP ablations (extensive decrease).

Discussion: This study used a stepwise ablation approach in subject-specific computational models to provide a means to guide effective therapy guidance towards optimal patient outcomes. Targeting pathologic propagation identified during AF effectively reduces AF complexity, and potentially improves long-term freedom from AF. □

Figure 1: Respiratory pattern before versus after ablation





Oral Abstracts 2 – Arrhythmia Mechanisms/*In Silico* Tools

27/Spatial resolution requirements for analysing atrial fibrillation wavefront patterns: Insights from virtual patient models

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr27

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Background: The spatial resolution of a mapping catheter is determined by factors such as the quantity of electrodes, their inter-electrode spacing, and the various configurations in which they are utilized. These factors impact the interpretation of wavefront dynamics during cardiac arrhythmias. Virtual patient models incorporating simulated arrhythmias offer an ideal dataset for evaluating the spatial resolution requirements, given that the precise propagation of high-resolution wavefronts is known from the high-resolution simulated data. We aimed to use a virtual patient cohort with different substrate heterogeneities and electrode set-ups to investigate the spatial resolution requirements for assessing atrial fibrillation (AF) wavefront patterns.

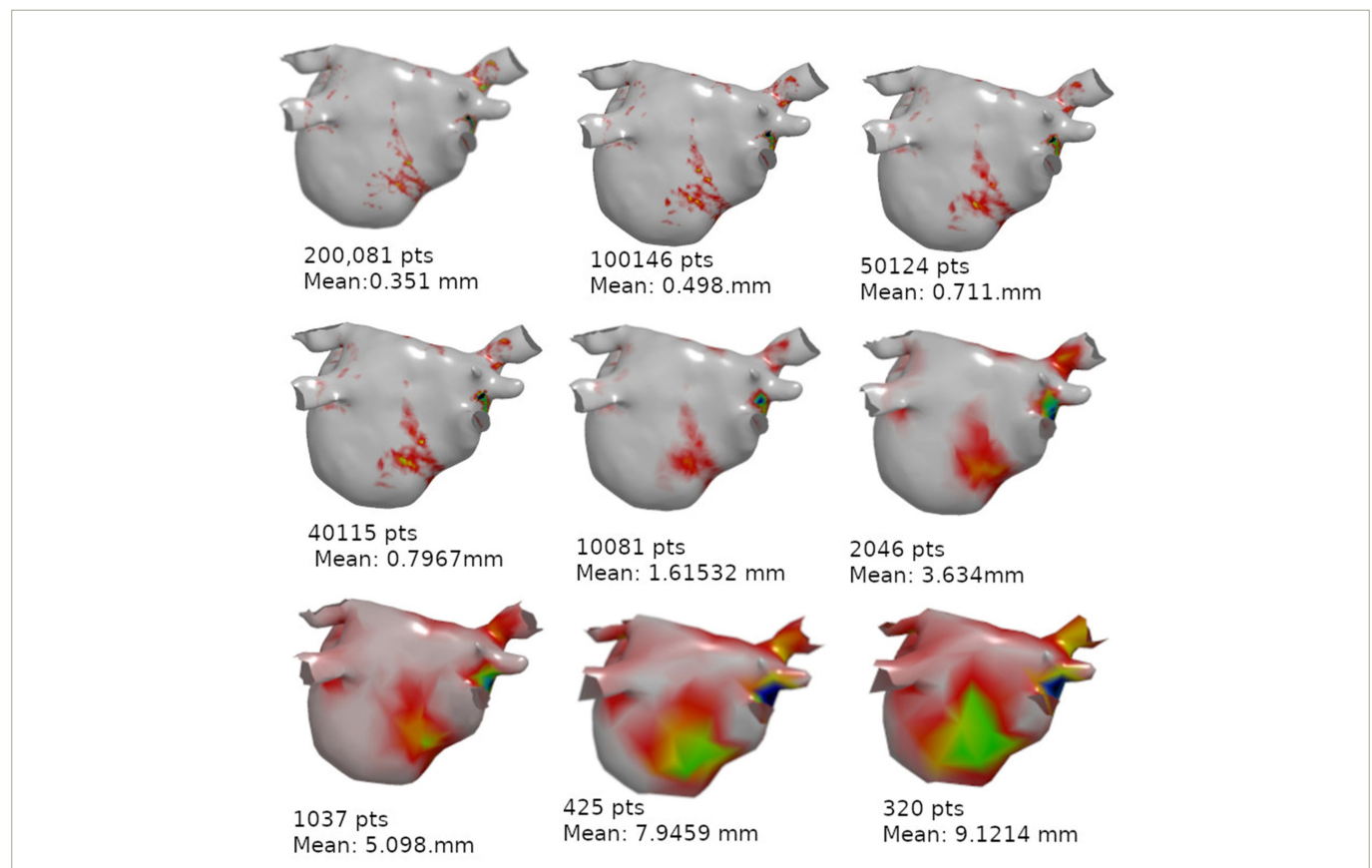
Methods: An AF model was developed where wavefront activity included areas of rotation, wavefront break-up, and focal activity. Specifically, left atrial meshes were constructed from segmented late-gadolinium enhancement MRI data, with the simulation mesh consisting of approximately 200,000 points. This high-resolution mesh served as the baseline model for subsequent down sampling and phase singularity (PS) point calculations. The purpose of these calculations was to derive a visual representation of the re-entry patterns and areas of wavefront

break-up associated with the arrhythmia. The downsampling process and PS calculation were iteratively performed on each downsampled mesh until the identification of new false PS points or until PS points obtained on the high-resolution mesh were no longer identified in the downsampled mesh (missing detections).

Results: Downsampling the meshes affected the propagation of the wavefront, resulting in larger regions with decreased precision in the localization of PS points. This is visualized in Figure 1, which shows an example of how spatial resolution affects the visual interpretation of AF. We found that the critical resolution for the identification of areas of re-entry during AF is 320–350 recording points across the left atrium, corresponding to an average inter-electrode distance of 8.0–9.1mm.

Conclusions: Careful consideration of the spatial resolution of recordings is of utmost importance in the interpretation of human AF data, as it plays a substantial role in accurately understanding the underlying AF mechanism. The utilization of virtual patient models provides an additional perspective on these and other factors, thereby presenting a significant opportunity to enhance the interpretation of arrhythmias. □

Figure 1: PS comparison between high resolution mesh and downsampled meshes, below each model is the number of points and the mean edge length



Oral Abstracts 2 – Arrhythmia Mechanisms/*In Silico* Tools

28/Advancing atrial fibrillation inducibility prediction: Insights from biatrial modelling

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr28

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Introduction: Recent clinical and mechanistic modelling studies have identified the significance of the right atrium (RA) in understanding the mechanisms underlying atrial fibrillation (AF) recurrence, though its role for each individual patient remains unclear. Predicting patient-specific response to treatment to guide therapy requires a framework for integrating personalised anatomy, fibrosis, and electrophysiology data. The first aim of this study was to develop an open-source biatrial modelling pipeline to construct personalised biatrial models integrating these data. The second aim was to use these models to assess AF inducibility and predict AF ablation outcomes for an individual patient on clinical timescales.

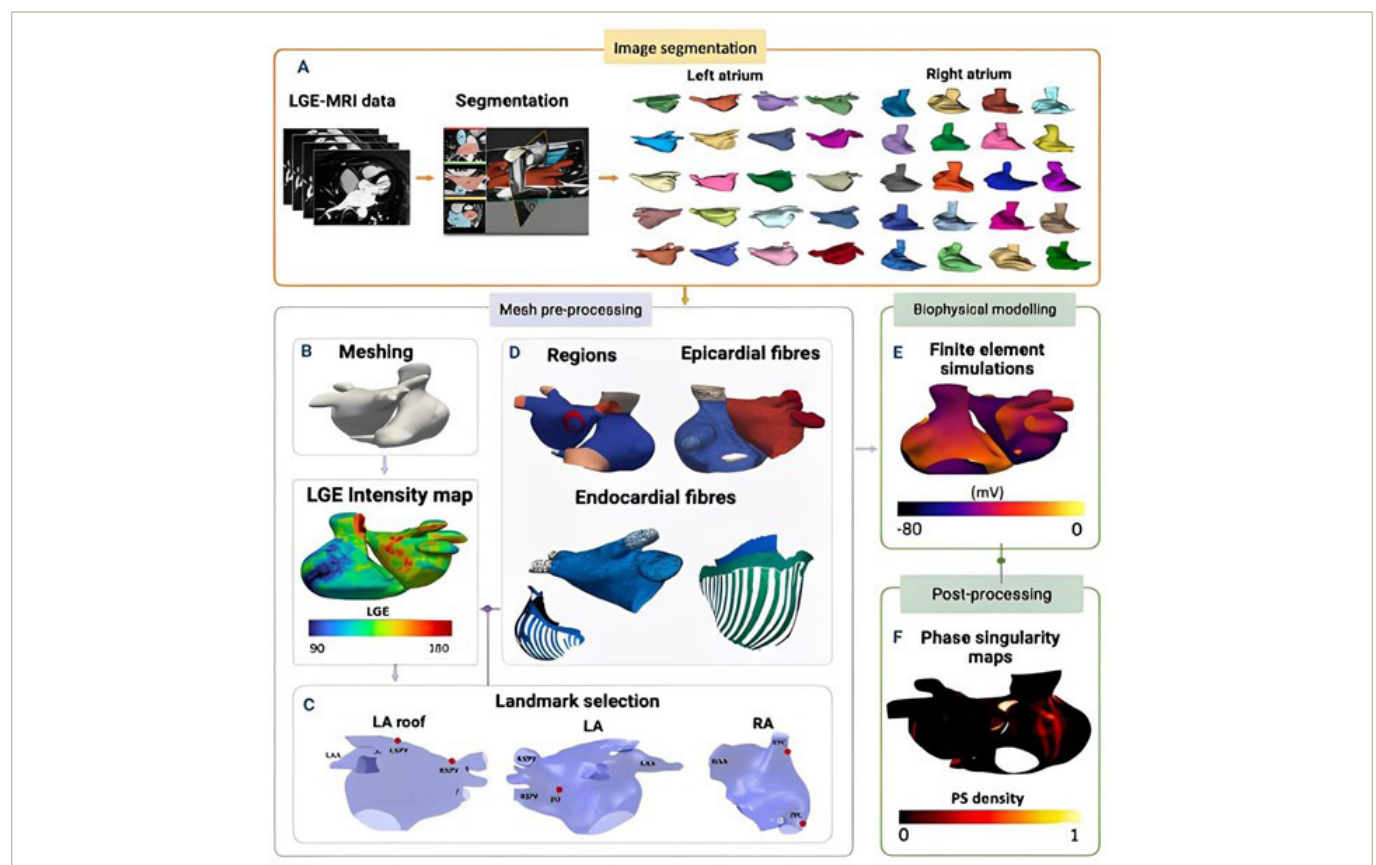
Methods: Patient-specific models were constructed from late-gadolinium enhanced-MRI scans for a total of 70 patients from the Atrial Segmentation Challenge Dataset (2018). The construction of such models entailed manually delineating atrial substructures (Figure 1A) and pre-processing meshes to quantify scar fibrosis (Figure 1B), followed by landmark selection (Figure 1C) and inclusion of atrial fibres from an atlas (Figure 1D). Each patient-specific model incorporated atrial fibrosis, atrial fibres, structures, and electrical parameters to investigate variances in atrial properties and assess AF inducibility. Finally, finite

element simulation stress tests were performed (Figure 1E) and post-processed to evaluate variations in atrial fibrillation wavefront patterns (Figure 1F). Different ablation approaches were simulated across the cohort, including pulmonary vein isolation and fibrosis-based ablation.

Results and discussion: The integration of the right atrial substrate resulted in significant increases in driver activity and in the total number of drivers (indicated by phase singularities) in the posterior region of the left atrium (LA) across the cohort, indicating that AF is more likely to be sustained. The LA had a greater mean phase singularity density of 3.8 phase singularities/cm² than the RA, indicating that targeting the LA is critical in preventing AF recurrence. The biatrial phase singularity density maps demonstrated a significant increase in localised regions with elevated phase singularity density, indicating regions of re-entry or wavefront break-up.

Conclusion: A model construction pipeline demonstrates that biatrial models have the potential to be efficient tools for predicting AF treatment outcomes and personalising therapy on clinical timescales. We are using our pipeline to compare different ablation approaches and anti-arrhythmic drug therapies. □

Figure 1



Oral Abstracts 2 – Arrhythmia Mechanisms/*In Silico* Tools**29/Autonomic modulation impacts conduction velocity dynamics and wavefront propagation predisposing to an environment that increases susceptibility to re-entry formation in atrial fibrillation**

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr29

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Introduction: Scar and autonomic remodelling are proposed pathophysiological mechanisms in atrial fibrillation (AF). Autonomic remodelling has been shown to trigger ectopy that initiates AF. In animal models, autonomic remodelling shortens the atrial effective refractory period and wavelength of the cardiac impulse, which in turns increases the probability of multiple re-entrant circuits existing simultaneously and thereby enhance AF maintenance. In humans, it is unclear how autonomic remodelling impacts electrophysiological properties. In this study, the impact of autonomic modulation on CV dynamics and wavefront propagation was evaluated.

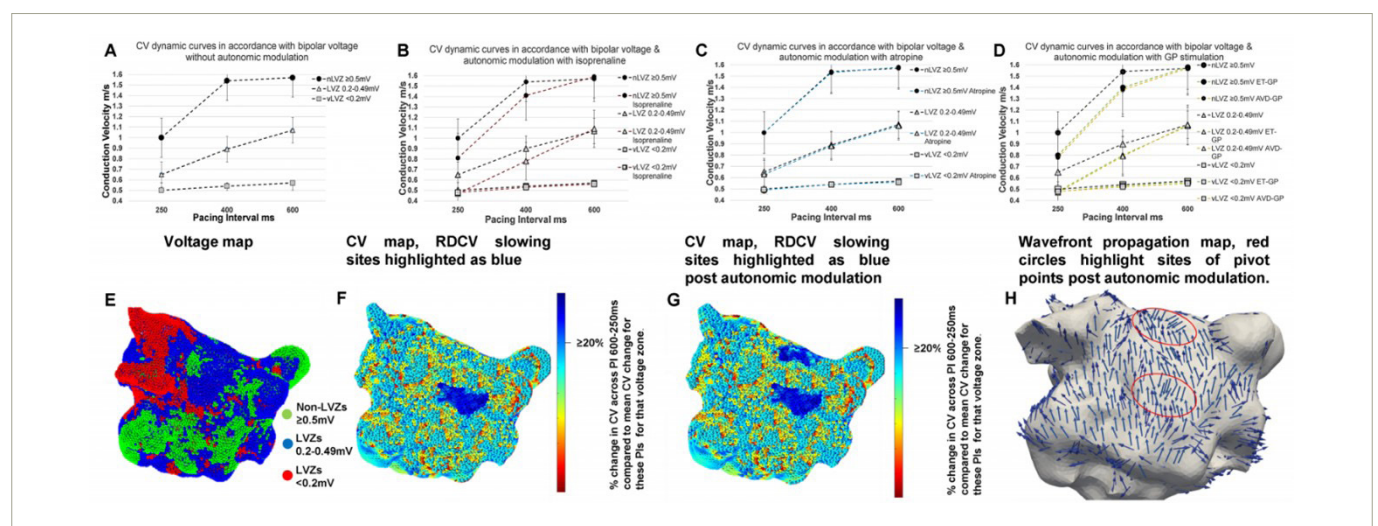
Methods: Local activation times (LATs), voltage and geometry data were obtained from patients undergoing ablation for persistent AF. LATs were obtained at 3 pacing intervals (PI) (600, 400 and 250 ms) sinus rhythm (SR). LATs were used to determine CV dynamics and their relationship to voltage. Sites of enhanced CV heterogeneity was identified in all patients, defined as rate dependent CV (RDCV) slowing sites, which are zones exhibiting a reduction in CV between PI=600 ms and PI=250 ms of $\geq 20\%$ of the mean CV reduction seen between these PIs for that voltage zone. The impact of autonomic modulation, pharmacologically and with ganglionated plexi (GP) stimulation, on CV dynamics and wavefront propagation was determined i.e., pivot points (change in wavefront propagation of $\geq 90^\circ$).

Results: Fifty-four patients were included. Voltage impacted CV dynamics whereby at nLVZ (≥ 0.5 mV) the curves are steeper (0.03 ± 0.02 m/s Δ CV PI 600–400 ms [PI1], 0.54 ± 1.1 m/s Δ CV PI 400–250 ms [PI2]), broader at LVZ (0.2–0.49 mV) (0.16 ± 0.09 m/s Δ CV PI1, 0.23 ± 1.1 m/s Δ CV PI2) and flat at

vLVZ (<0.2 mV) (0.04 ± 0.01 m/s Δ CV PI1, 0.05 ± 0.02 m/s Δ CV PI2). RDCV slowing sites were identified in all patients, with an average of 2.8 ± 1.1 RDCV slowing sites per patient with a total of 149 RDCV slowing sites. RDCV sites were predominantly seen in LVZs (0.2–0.49 mV) (117/149, 78.5%). No RDCV sites were demonstrated in vLVZs (<0.2) and the remaining 32 (21.5%) RDCV slowing sites were seen in nLVZs (≥ 0.5 mV). Out of the 54 patients, 24 (44.4%) and 30 (55.6%) patients had CV maps created with autonomic modulation pharmacologically and through GP stimulation respectively. Atropine did not impact CV dynamics, whilst isoprenaline and GP stimulation resulted in enhanced CV slowing with rate (Figure 1A–D). Isoprenaline (2.7 ± 1.1 increase per patient) and GP stimulation (2.8 ± 1.3 increase per patient) resulted in enhancement of CV heterogeneity sites i.e., RDCV slowing sites (Figure 1E–G). Most pivot points co-located to RDCV slowing sites (80.2%). Isoprenaline (1.7 ± 1.2 pivot points per patient) and GP stimulation (1.9 ± 1.1 pivot points per patient) also enhanced the number of pivot points identified. Figure 1H demonstrates two pivot points (red circle) seen post autonomic modulation of which only one was present without autonomic modulation.

Conclusion: This is the first study that has evaluated the impact autonomic modulation has on electrophysiological properties in humans. The study has shown that CV dynamics is impacted by scar and influenced by autonomic modulation which enhanced CV heterogeneity and distribution of pivot points. This study has shown that autonomic modulation enhances an environment that increases susceptibility to re-entry formation. This study provides further insight to the impact of autonomic remodelling in AF. □

Figure 1



Oral Abstracts 3 – Devices

30/Identifying the effects reduced ventricular pacing modes and algorithms have on estimated pacemaker battery longevity

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr30

Authors: [OB Hamer](#) (Presenting Author) - Wythenshawe Hospital, Manchester, UK

Background: The way that dual chamber pacemakers are programmed can affect the estimated battery longevity. This remaining battery life is calculated by the device itself; it is unknown how specific variables such as reduced ventricular pacing modes/algorithms and rate response effect the estimated battery longevity. This therefore forms the primary aim of this study. Whilst current research into the incidence of atrioventricular block in patients with sick sinus syndrome appears reliable, there are inconsistencies amongst studies. Furthermore, the issue of unnecessary right ventricular pacing in this cohort is yet to be challenged consistently. As a result, this study further identifies changes in right ventricular pacing percentage over time. Both aims were investigated in patients with dual chamber pacemakers, implanted for sick sinus syndrome with no atrioventricular block.

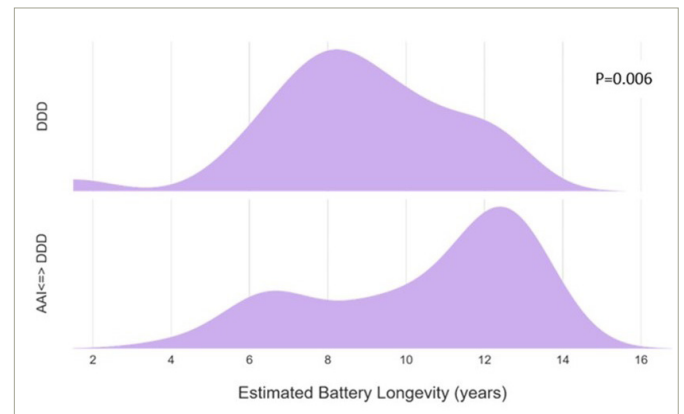
Methods: This single centre, retrospective, observational cohort study includes all patients with dual chamber pacemakers implanted for sick sinus syndrome between 2015–2020 at Wythenshawe Hospital. Inclusion criteria was having documented follow-up data at both 6 weeks and 2 years post implant.

Statistical analysis on the data set was commenced using a Kruskal Wallis test to identify any significant effect on battery longevity as a result of different programmed modes. Following this, multiple Mann Whitney tests (post-hoc analysis) identified specifically which of the programmed modes had significant effects on battery longevity. Furthermore, a Wilcoxon signed rank test was used to identify differences in right ventricular pacing percentage between 6 weeks and 2 years post implant.

Results: The primary aim, investigating effects of programmed modes on estimated battery longevity, found differences in some of the comparisons between modes. Following a significant Kruskal Wallis result ($p < 0.001$), a significant difference in battery was then found between AAI \leftrightarrow DDD compared with AAIR \leftrightarrow DDDR ($n=99$; $p < 0.001$), and secondly between AAI \leftrightarrow DDD and DDD ($n=79$ $p=0.006$) as shown in the density curve below (Figure 1). However, there was statistically similar longevity between DDD and DDDR ($n=66$ $p=0.352$), and between AAIR \leftrightarrow DDDR versus DDDR ($n=86$; $p=0.568$).

Furthermore, the secondary aim of identifying changes in right

Figure 1



ventricular pacing percentage used a Wilcoxon signed rank test, identifying a significant increase ($n=174$; $p=0.001$) between 6 weeks and 2 years post-implant.

Conclusion: Different programmable modes in dual chamber pacemakers can significantly affect the estimated battery longevity. The most prominent finding and significant comparison demonstrates that patients programmed DDD could have an increased estimated battery longevity (by 1.75 years) if re-programmed with a reduced ventricular pacing mode (AAI \leftrightarrow DDD) enabled. Furthermore, where these modes/algorithms are not appropriate for the patient, DDDR should be enabled. No significant difference in battery was identified between DDD and DDDR (enabling rate response).

Crucially, the study also found that right ventricular pacing percentage significantly increases over time (11.4% to 16.5%) confirming the suggestions of current research that implanting dual chamber pacemakers for sick sinus syndrome has the potential to pace the ventricle unnecessarily. Careful consideration of reprogramming is vital. Weighing up achieving optimal haemodynamic and quality of life for patients, whilst also preserving battery longevity must be considered. □

Oral Abstracts 3 – Devices

31/Involuntary arm movements post-pacemaker insertion: Real or Reel syndrome?

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr31

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Background: Twiddler syndrome, and the variant Reel syndrome, are rare but important complications of pacemaker implantation.

Case summary: We describe a rare complication of conventional permanent pacemaker implantation of rhythmic arm twitching secondary to brachial plexus stimulation from a displaced pacing lead caused by Reel syndrome.

Discussion: Twiddler syndrome and its variants are rare but important complications of pacemaker insertion. Holistic planning of cardiac procedures in elderly patients should identify those at risk to allow for targeted education and post-procedural care.

Conclusions: The pacemaker and the displaced leads were removed and replaced, with the pacemaker device being placed in a sub-pectoral pocket and correct placement of the pacing leads confirmed by chest radiography. This case provides excellent images of Reel syndrome seen on a chest radiograph (Figure 1), and highlight the benefits of holistic planning of cardiac procedures in elderly patients, as well as the importance of considering pacemaker lead displacement as a cause of left-sided abnormal movements. □

Figure 1: Calculated aortic and pulmonary artery pressures, as well as stroke volume, during a simulated change in programming for 20 seconds followed by reversion back to baseline



Left panel: original pacemaker implantation. Chest radiograph shows a dual-chamber pacemaker with correct placement of pacing leads in the right atrium and right ventricle, and the pacemaker device situated in the left pectoral region.

Central panel: Reel syndrome. Chest radiograph shows a rotated pacemaker device with coiling of the pacing leads around the device body. The distal ends of the pacing leads are seen inferior to the left clavicle and medial to the left glenoid fossa.

Right panel: re-do pacemaker implantation. Chest radiograph shows correct placement of pacing leads as well as the pacemaker body which is now situated slightly more lateral than previously in a deeper sub-pectoral pocket.



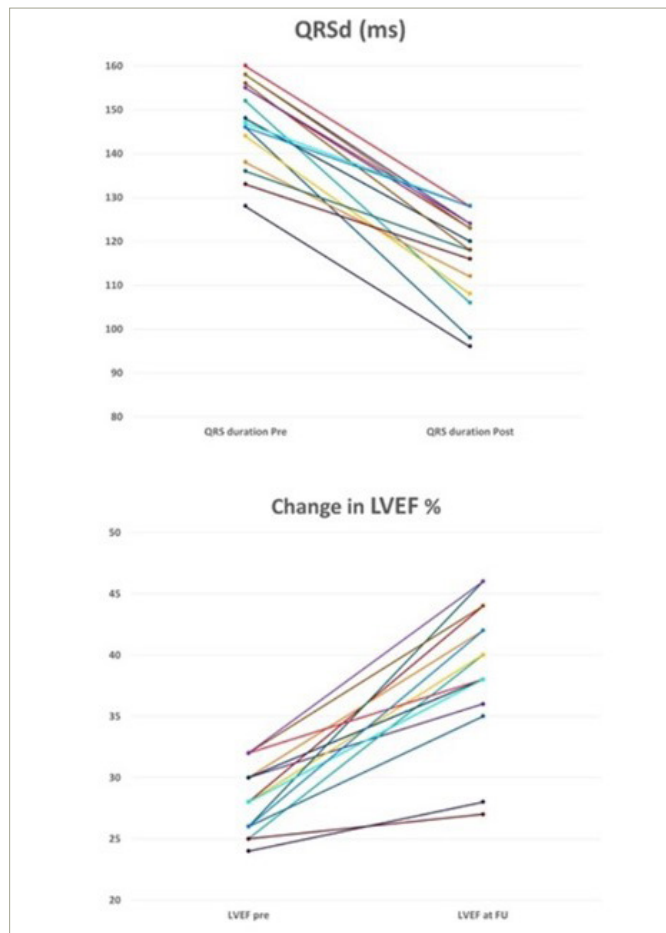
Oral Abstracts 3 – Devices

32/Left bundle branch area pacing in patients with CRT Indication: Short-term results and 1-year follow-up

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr32

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Figure 1: Changes in QRS duration and ejection fraction at follow up



Background and objectives: Cardiac resynchronization therapy (CRT) using bi-ventricular pacing is class I recommendation for symptomatic patients with heart failure (LVEF $\leq 35\%$), QRS duration ≥ 150 msec and LBBB QRS morphology. Left bundle branch area pacing (LBBAP) has been reported as an alternative option for CRT. The aim of this study was to assess the feasibility and outcomes of LBBAP in patients eligible for CRT.

Methods: Patients with CRT indications were subjected to LBBAP. Peri-procedural outcomes & QRS duration were recorded. Changes in New York Heart Association (NYHA) class, need for HF hospitalization, echocardiographic data, lead-device parameters were evaluated at follow-up. HF status was assessed by clinical (no HF hospitalization and improvement in NYHA class) and echocardiographic response ($\geq 5\%$ improvement in LVEF).

Results: LBBAP was attempted in 16 patients (mean age 59.3 ± 7.04 years, 37.5% women, ischaemic cardiomyopathy in 33.3%). All patients had baseline LBBB. Pacing threshold and R-wave amplitudes were 0.8 ± 0.3 V at 0.5 ms and 12.1 ± 3.5 Mv at implantation and remained stable during mean follow-up of 11.25 ± 3.7 (range 6–18) months. LBBAP resulted in significant QRS narrowing from 147.5 ± 9.7 to 116 ± 10.2 ms ($p < 0.01$). LVEF improved from $28.2 \pm 2.8\%$ to $38.9 \pm 5.1\%$ ($p < 0.01$). Clinical and echocardiographic improvement was observed in 77% and 74% of patients, respectively.

Conclusion: LBBAP is feasible, safe and provides an alternative option for CRT. LBBAP provides low and stable pacing thresholds and is associated with improved clinical and echocardiographic outcomes. □

Table 1: Baseline, procedural and outcome characteristics

n=16		Procedure time 100.2 \pm 10.6 min	
Age	59.3 \pm 7.04 years	Fluoro time (mean)	22.7 \pm 5.1 min
Women	6/16 (37.5%)	R wave (mean)	12.1 \pm 3.5 mV
CAD	5/16 (33.3%)	Threshold (mean)	0.8 \pm 0.3 V at 0.5 ms
QRSd (mean)	147.5 \pm 9.7 ms	N=16 Mean Follow up = 11.25 \pm 3.7 (6-18) months	
LVEF (mean)	28.2 \pm 2.8%	QRSd (msec) (mean)	147.5 \pm 9.7 116 \pm 10.2
		LVEF (mean)	28.2 \pm 2.8% 38.9 \pm 5.1%



Oral Abstracts 3 – Devices

33/The safety of same-day discharge following leadless pacemaker implantation

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr33

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Introduction: Transcatheter leadless pacemakers are increasingly being used for the treatment of bradyarrhythmia. Data following conventional transvenous pacemaker implantation suggests same-day discharges are safe and have become the standard of care in many institutions around the world. There is limited data regarding same-day discharges in patients undergoing leadless pacemaker implantation.

Purpose: To assess the feasibility and safety of same-day discharge following leadless pacemaker implantation and, to determine the potential influencing factors on decisions about the suitability for same-day discharge.

Methods: A retrospective study was conducted examining all leadless pacemaker implantations between May 2016 and December 2022 at Glenfield Hospital, Leicester. The baseline patient characteristics, procedural details and follow up data were collected. Factors judged to influence the appropriateness for same-day discharge were also identified. The outcomes of those patients who underwent same-day discharge were compared to those who remained in hospital overnight or more than 1 day post implantation.

Results: In total, 128 patients received a leadless pacemaker; 75 male and 53 female. The mean age was 56.6 years (range: 16–92 years). The indications for pacing were sinus node disease (23%), AF with complete heart block (11.7%), AF with slow ventricular response (15.6%), high grade AV block (32.8%), pre-AV node ablation (6.25%) and neurocardiogenic syncope (10.9%). Haemostasis was achieved at the puncture site with the use of a 'figure of 8' suture ± closure device.

A total of 50 patients (39%) were discharged on the same day and 48 patients (37.5%) were discharged the following day. Twelve patients (9.3%) and 7 patients (5.4%) stayed in hospital for the next 2–3 days and 4–7 days respectively. Eleven patients (8.5%) were hospitalised for longer than 7 days. Factors which influenced decisions about the appropriateness for same-day discharge included patient frailty, the presence of co-morbidities which required subsequent in-patient care, the finishing time of the procedure, intra-procedural complications and social circumstances.

In the group as a whole, one patient had device microscopic migration at 3 months which required recapturing and the deployment of new leadless pacemaker implant. Two patients developed a haematoma and 1 patient had access site bleeding, all of which were managed conservatively. No other complications were identified.

Among the same-day discharge patients, one patient had access site bleeding and one patient developed haematoma. Both patients required readmission and an additional one-night stay in hospital. Overall, there was no increased complication rates observed in the same-day discharge group.

Conclusion: Our single-centre data suggests that same-day discharge after leadless pacemaker implantation is safe and feasible in appropriate patients, and is likely to reduce admission-related costs and improve patient throughput. □



Oral Abstracts 3 – Devices

34/Risk factors for cardiac implantable electronic device infection and their influence on mortality

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr34

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Introduction: With advances in cardiac resynchronisation therapy (CRT) equipment and operator experience, implant success is increasing. However, the commonest cause for procedural failure remains a lack of suitable pacing site due to an absent or insufficiently sized target vein. The role of computed tomography (CT) prior to CRT remains investigational, but improved imaging techniques allow assessment of target veins and access site patency. This may improve decision making for high-risk procedures.

Objectives: We sought to describe and assess the impact of CT prior to CRT upgrade/revision.

Methods: CT and fluoroscopic images were analysed for patients referred for CT prior to CRT upgrade/revision between 2015 and 2022 (Siemens SOMATOM Definition Flash 128-Slice Dual-Source CT Scanner and Siemens Syngo.via software) (Figure 1). Data obtained were: target vein identification on CT, target vein used at implant, subclavian vein patency, radiation dose and incidental findings.

Results: A total of 34 patients had CT prior to CRT upgrade/revision, mean age 73 years, 76% male. Reasons for upgrade were pacing-induced cardiomyopathy and/or deterioration of pre-existing cardiomyopathy (n=32), or LV lead displacement (n=2). Overall, 31 patients subsequently attended the lab. Subclavian vein patency was graded as patent, significantly stenosed or occluded with both CT and on-table venography (for patients attending the lab). There was 87% agreement between the two modalities. However, differentiating between stenosis and occlusion on CT is difficult. As such, these two findings were treated interchangeably for pre-procedure planning. If stenosis/occlusion are taken together the agreement between modalities is 98%. A suitable calibre posterior or lateral target vein was identified on CT in 32/34 cases (92%). Subclavian access was achieved in 27/31 patients attending the lab. In 26/27 cases (96%), CT accurately delineated cardiac vein anatomy. In 25/27 cases (92%) the target vein identified on CT was utilised. In one of the remaining cases, tight angulation prevented use of the CT-identified target; a small

Table 1: Logistic regression of mortality at 3 months as a function of the number of risk factors

	OR adj.	95%CI	OR adj.	95%CI
Intercept	0.003	(0.001; 0.01)	0.004	(0.001; 0.011)
Patient risk factors	1.735	(1.412; 2.154)	1.759	(1.436; 2.178)
Procedure and device risk factors	1.167	(0.859; 1.559)		

antero-lateral vein was used instead, though only three poles of a quadripolar lead were placed. In the second case, the target vein was occluded proximally and filled by small antegrade collaterals; an inferior bridging vein was used instead. Two patients did not proceed to upgrade partly due to poor targets on CT (small-calibre veins and/or suboptimal location); one declined given additional uncertainties of success, and the other was unsuitable for prolonged procedures due to advanced heart failure, which later required transfer for transplant assessment.

Mean CT radiation dose was 1426 mGy/cm. Median procedure radiation dose was 10192 mGy/cm². Four patients had significant incidental findings: three had a left atrial thrombus, requiring changes to anticoagulation, and one patient had a lung nodule, requiring follow-up imaging.

Conclusion: Cardiac CT prior to CRT upgrade/revision enhanced pre-procedural decision making and supported changes in patient management in this small cohort. CT accurately identified target veins. Assessing subclavian venous patency was more difficult, though there was still high concordance between CT and on-table venography. The CT radiation dose is high relative to other cardiac CT, due to the addition of detailed subclavian imaging. Subsequent adaptation of the CT protocol has reduced radiation dose, whilst still allowing assessment of subclavian anatomy and patency. □



Oral Abstracts 3 – Devices

35/A strategy of alert based follow up is safe and effective in selected patients with ICDs

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr35

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Introduction: The use of remote monitoring (RM) to undertake cardiac implantable electronic device (CIED) follow-up is becoming increasingly common, particularly following the COVID-19 pandemic. This method of CIED assessment has been shown to be non-inferior to face-to-face only assessments.

Purpose: We sought to assess the safety of adopting a strategy of alert based follow up in selected patients with implantable cardiac defibrillators (ICD), with a view to eliminating the need for routine visits where no actionable findings were identified.

Methods: We undertook a retrospective analysis of patients with ICDs, reviewing any RM alerts and all follow-up data, both in-clinic and scheduled RM, to establish whether any of this activity identified any additional clinically relevant findings. These were defined as any alerts that prompted initiation or change in medications or review by a medic, as well as any significant ICD re-programming/system revision.

We subdivided our alerts into two groups:

- system-related (e.g. elective replacement indication, poor sensing); and
- arrhythmia-related events (e.g. detection of atrial fibrillation [mode switch duration >6 mins], therapies delivered, VF).

The action taken was also divided into two groups or 'essential' and 'non-essential' programming:

- essential programming (e.g. reprogramming for surgery, changes to ICD therapies); and

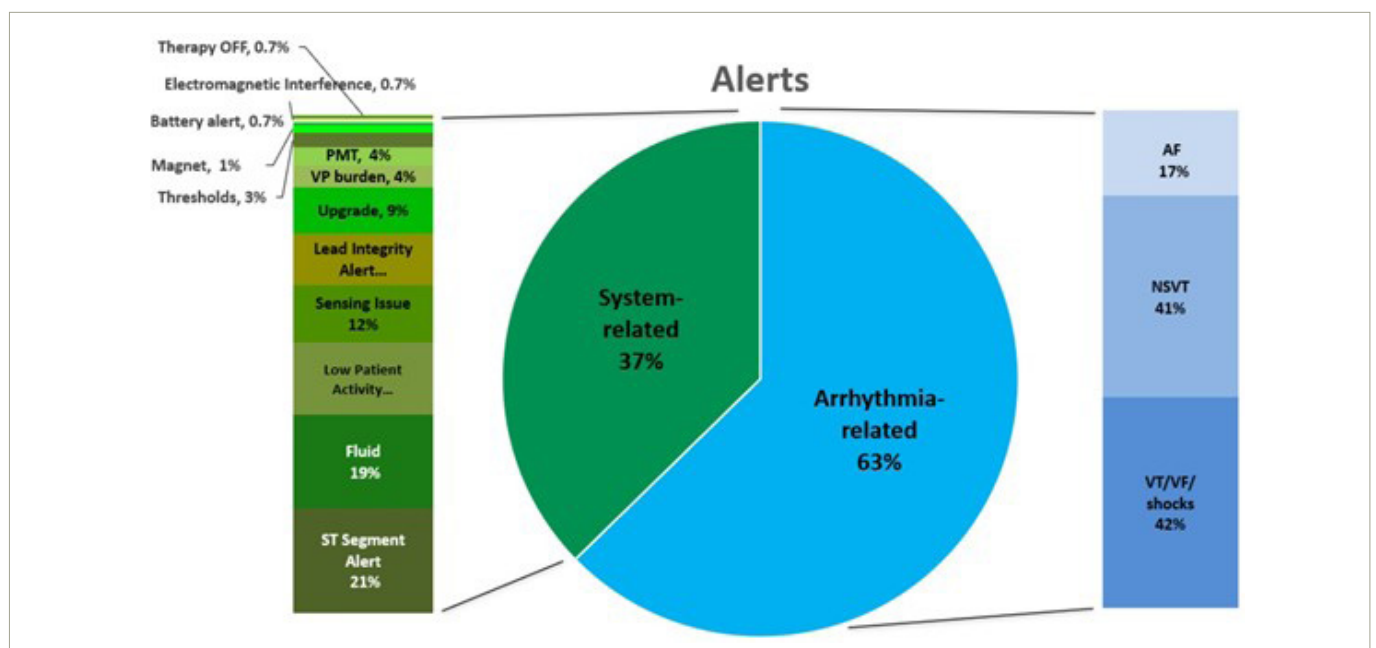
- non-essential programming (e.g. optimization of outputs, alterations to pacing mode).

Results: The study included 162 patients – mean age: 69 years \pm 25 years, 80% male gender, 44% primary prevention ICD, 4% were pacing dependent. CIED follow up was retrospectively reviewed for a period of 2 years (November 2019 – November 2021).

During follow up, a third of patients were disconnected from RM. We received 3,030 alerts in total, with an average of 253 RM alerts per month. Alerts were received from 43% of patients (total of 70 patients). However, only 70 out of the 3,030 alerts were clinically relevant, meaning just 2% of all alerts received were clinically meaningful. Relevant alerts were received from 30 patients, equating to 18% of the patient group. 63% of clinically relevant alerts were arrhythmia-related, while 37% were system-related. Crucially, all clinically relevant events were associated with a RM alert. No additional clinically relevant events were detected during in-clinic/scheduled RM.

Conclusion: A strategy of alert-based follow up would not have overlooked any clinically relevant events in our study. However, 98% of alerts relate to findings which were not clinically meaningful. While alert-based follow up appears safe, institutions must employ a robust process to ensure patients remain compliant with RM to ensure they do not disconnect from the service. It is also imperative that RM alert settings are optimally programmed, to prevent unnecessary clinical data from being transmitted. □

Figure 1





Oral Abstracts 3 – Mapping and ablation

36/Omnipolar vector disarray in tandem with low ventricular voltage highlights arrhythmogenic tissue within post-infarct scar

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr36

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Introduction: Understanding post-infarct VT substrate relies on a combination of voltage and activation mapping. These maps are often analysed separately. Omnipolar electrograms (Omni-EGMs) offer a novel approach to mapping, with local activation displayed as a vector. We describe an approach to characterize the post-infarct ventricular arrhythmic substrate using omni-vectors superimposed onto omni-voltage maps for review ‘in tandem’.

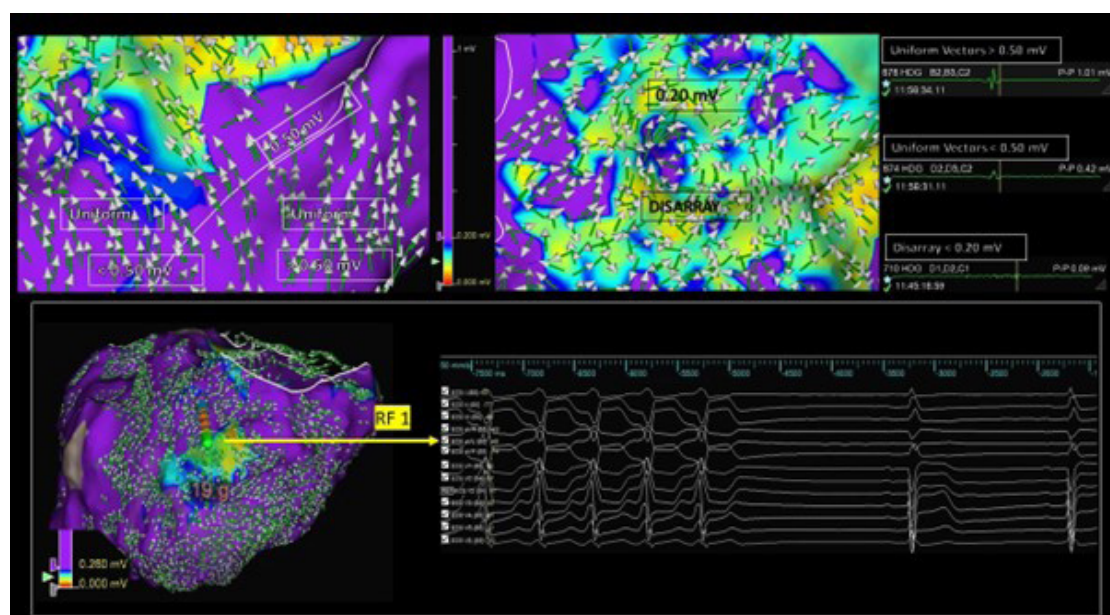
Methods: Consecutive patients who underwent VT substrate mapping (EnSite X + HD Grid catheter) using omnipolar technology (OT) at our institution were retrospectively studied. Omni-voltage maps were displayed between 0–1.5 Mv, with tissue >1.5 Mv coloured purple, and tissue below coloured according to the rainbow spectrum between red (lowest voltage) to blue. Omni-vectors were superimposed onto omni-voltage maps. Vectors were either categorized as pointing in the same direction, suggesting activation ‘uniformity’, or in multiple unpredictable directions, suggesting ‘vector disarray’ (VD). This is demonstrated in Figure 1 (top panel). The upper voltage limit on the omni-voltage map was sequentially reduced until only those areas with VD appeared ‘non purple’ – this voltage limit was termed the ‘vector disarray threshold’ (VD-Th) and was identified in each patient. We compared the location of the putative VT isthmus relative to areas of VD.

Results: Ten consecutive patients post-MI (mean age 61 ± 14 years;

mean LVEF $34 \pm 7\%$, median 3 [IQR: 2–5.5] VT episodes in the prior 3 months) were studied. Dense LV substrate maps ($4,232 \pm 2,608$ points) were collected with the HD Grid catheter. Three patients were also mapped in VT. The mean VD-Th was 0.26 Mv (range: 0.18–0.50 Mv). VD covered a significantly smaller shell area than the traditional 0.50 Mv voltage threshold used to define scar (16.1 ± 11.0 versus 44.0 ± 22.6 cm², $p < 0.01$). VT isthmus components collocated within tissue bordering the VD-Th. In patients who could not be mapped in VT, pace-mapping within the VD-Th border zone offered excellent correlation to clinical VTs. The figure demonstrates VT termination with radiofrequency ablation (RF-1) in the VD-border zone of an inferior scar. A mean of 21.3 ± 7.3 mins of substrate ablation was delivered, with most lesions collocating within and around the VD-Th. VT was non-inducible in 9 (90%) patients post-ablation, with a significant VT burden reduction in early follow-up: median 0 episodes at 3 months post-ablation, $p < 0.01$.

Conclusions: Omni-vectors within post-infarct ventricular tissue can appear organised (uniform) or in disarray. When studied in tandem with a voltage map, disarray is observed at voltages considerably lower than the traditional 0.50 Mv threshold used to define scar. Low voltage tissue bordering vector disarray appears to correlate with VT isthmus components, potentially identifying ablation targets. □

Figure 1



Oral Abstracts 3 – Mapping and Ablation

37/Combining dominant frequency and organization index for improving AF substrate identification in persistent atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr37

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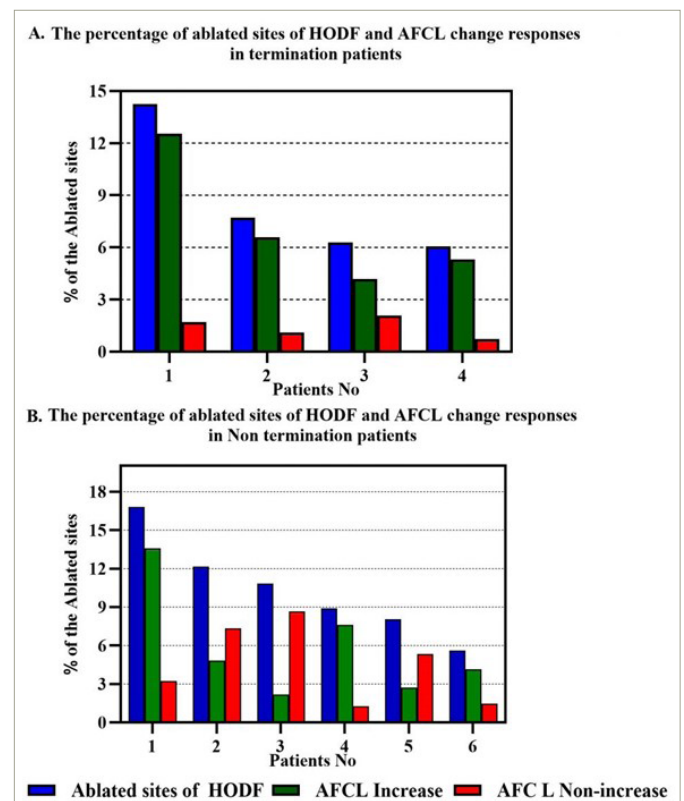
Introduction: Identifying ablation targets for persistent atrial fibrillation (PersAF) remains challenging. Dominant frequency (DF) and organization index (OI) of atrial electrograms (AEGs) are proposed to identify driver sites that contribute to AF perpetuation. This work aims to use DF and OI together to identify atrial regions with organised, fast activation rates based on electrophysiologic responses following AF substrate ablation.

Methods: 2,048 channels of non-contacting AEGs (60 s, EnSite Array, Abbott) were analysed from 10 patients with PersAF undergoing highest DF-guided ablation with no prior ablation history. After QRST subtraction, AEGs were divided into 15 segments (4 s each, 50% overlap). The fast Fourier transform (FFT) was used to calculate (DF 4–10 Hz, and OI). Segments with (DF 4–10 Hz, and OI >0.4) were selected as highly organised DF (HODF). The change in AF cycle length (AFCL) was measured pre- and post-ablation (≥ 10 ms considered significant). AF termination is defined as either converting AF to sinus rhythm (SR) or converting AF into an organised rhythm within the left atrium (LA). AEGs were classified into two groups: those collected from regions where ablation led to a AFCL increase (≥ 10 ms) and those with a AFCL non-increase (< 10 ms). Spatial analysis compared pre-ablation HODF sites with sites with AFCL changes during ablation for terminated and non-terminated patients.

Results: A total of (3,206 AEGs) were analysed for 10 patients: AFCL increased in 30% of ablated AEGs, and AFCL did not increase in 70% of ablated AEGs. Although the percentages of non-ablated HODF sites were high in terminated and non-terminated patients (mean \pm SD: 91 ± 2.9), the results indicate a good spatial correlation between the ablated HODF sites and sites of AFCL increase in terminated compared to non-terminated patients (see Figure 1, A and B). DF were higher and more organised in terminated patients pre-ablation compared with non-terminated (DF: 5.82 ± 1.9 Hz, OI: 0.42 ± 1.49 versus DF: 5.2 ± 0.8 Hz, OI: 0.32 ± 1.14 , $P < 0.001$ respectively). Post-ablation HODF in terminated patients showed a significant reduction (pre: 5.72 ± 1.9 Hz versus post: 4.2 ± 0.5 Hz, $p < 0.001$). In contrast, non-terminated patients exhibited no significant change in HODF (mean \pm SD: pre: 5.54 ± 1.62 Hz versus post: 5.2 ± 0.8 Hz, $p = \text{ns}$).

Conclusions: DF and OI have been suggested individually for guiding ablation. Our findings indicate that combining DF and OI might help identify AF substrates with organised, rapid activation rates for ablation substrates. Adaptable thresholds of DF and OI might help improve the characterization of AF substrates for each patient. \square

Figure 1



A: the blue bars in the graphs represent the percentage of ablated HODF sites out of the total sites exhibiting HODF and AFCL change responses. Green bars indicate an increase in AFCL, while red bars represent a non-increase in AFCL termination in patients. B: non-terminated patients.



Oral Abstracts 3 – Mapping and Ablation

38/Very high-power short duration (90 W 4 sec) radiofrequency pulmonary vein isolation ablation under mild conscious sedation – Can it compare with conventional 50 W ablation?

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr38

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Introduction: Very high power, short duration ablation (Vhpsd) involves using radiofrequency (RF) ablation powers of 90 W for just 4 seconds per lesion, delivered using the Q-DOT ablation catheter (Biosense Webster). We have shown how shorter ablation lesions improve patient comfort during pulmonary vein isolation (PVI) and may obviate the need for general anaesthesia. It is less clear how the lesion integrity and longer-term efficacy of this approach compares to high power, short duration (HPSD; 50W) ablation. In this analysis, we contrast a cohort of patients undergoing Vhpsd PVI under mild conscious sedation (MCS) against a contemporaneous cohort of similar number who underwent conventional HPSD ablation.

Methods: We retrospectively identified all patients who underwent RF PVI at our institution between March 2021 (release of the Q-DOT catheter) to December 2022 (to give a minimum of 6-month follow-up). Our exclusion criteria included: 1) non-Q-DOT catheter ablation, 2) all redo ablations, 3) PVI with additional left atrial ablation, 4) cases lacking follow-up, 5) Q-DOT hybrid 90/50 W ablations, and 6) Vhpsd under GA. Demographics, procedural characteristics, lesion data and follow-up outcomes were evaluated.

Results: We identified 48 patients who underwent Vhpsd PVI under MCS, and 38 patients who underwent exclusively 50 W Q-DOT HPSD PVI (58% under general anaesthesia). There were no statistically significant

differences between the groups in terms of demographics, AF type, and CHA2DS2Vasc score.

A total of 6,701 ablation lesions were analysed. Vhpsd lesions achieved similar mean contact force, stability and impedance drop as HPSD. However, first-pass isolation rates were lower with Vhpsd (58% versus 74%; $p=0.144$), requiring a greater number of ablation lesions per patient (82.8 ± 22.6 versus 63.4 ± 13.1 ; $p<0.001$). Given the shorter individual lesion delivery between the two approaches, the total ablation duration was shorter (329.7 ± 90.6 sec versus 917.3 ± 211.8 sec <0.001), resulting in equivalent procedural times (117 mins versus 114 mins; $p=0.615$).

Follow-up duration was longer in the Vhpsd group (12 months versus 8.4 months; $p=0.008$). We applied a 2-month post-ablation blanking period. Recurrence rates of any sustained atrial arrhythmia at follow-up were similar between groups (22.9% versus 28.9%; $p=0.525$).

Conclusion: Vhpsd ablation (90W–4sec) under mild conscious sedation using the Q-DOT catheter is a viable alternative to conventional 50 W ablation that can require a general anaesthetic to tolerate longer lesions (8–15 sec). Although Vhpsd under MCS incurs lower first pass PV isolation rates requiring more lesions, the overall procedural times remain similar, as are arrhythmia recurrence rates at around 12 months. Vhpsd should be considered an alternative approach to RF PVI when the availability of general anaesthesia is limited. □



Oral Abstracts 3 – Mapping and Ablation

39/Prospective and randomized study comparing PVAC gold catheter ablation versus clinical treatment in elderly patients with symptomatic atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr39

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Aims: Compare catheter ablation (CA) using second-generation pulmonary vein ablation catheter (PVAC) gold technique with clinical treatment in elderly patients with symptomatic paroxysmal AF (PAF), without structural heart diseases.

Methods: Prospective randomized study selected consecutive patients with paroxysmal AF ≥ 65 years in 2 groups: (1) the PVAC CA group and (2) the antiarrhythmic drug (AAD) therapy group. Primary outcomes were AF recurrences, progression to persistent AF forms and QoL score.

Results: Sixty patients were enrolled (mean age 72 ± 4.9 years, 50% female), and baseline characteristics were similar in both groups. Acute cerebral lesions identified on MRIs (secondary endpoint) occurred in 8 (26.6%) patients undergoing CA, only 1 with transient symptoms, with no impact in a 1-year Mini-Mental State evaluation in any patient. An overall

pooled analysis showed that, compared to AADs, CA was associated with no significantly higher freedom from arrhythmia recurrence (80.0% versus 64.3%, $P=0.119$) or persistent AF (83.4% versus 67.7%, $P=0.098$) in a median follow-up of 719 days (Q1: 566; Q3: 730). Both strategies presented similar improvement in the QoL score during the follow-up, ($P<0.001$). However, most patients undergoing CA remained without amiodarone and other AADs (10% versus 40%, $P=0.007$).

Conclusions: Both strategies showed similar recurrence rates, without differences in QoL scores. CA group suggested a potential for a lower probability of progression to persistent forms of AF and reduced use of amiodarone in the follow-up. However, a significant number of patients presented cerebral lesions on early MRI post-ablation evaluations. □



Oral Abstracts 3 – Mapping and Ablation

40/Transmural activation mapping for complex ventricular arrhythmias with high frame rate transthoracic echocardiography: Non-invasive identification of intramural and subepicardial sites of origin with electromechanical wave imaging

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr40

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Introduction: The restriction of activation mapping to the ventricular surface of contemporary mapping systems often leads to failure to correctly identify the true site of origin (SOO) of intramural and/or sub-epicardial VAs and lower procedural success. Electromechanical wave imaging (EWI) is a non-invasive echocardiography-based high frame rate technology that offers direct transmural activation mapping and may allow to overcome the limitations of established mapping approaches.

Methodology: Patients with complex ventricular ectopy (VE) and clinical indication for VE-ablation were recruited to undergo preprocedural EWI to identify the SOO and validate against contact mapping. The study has received a favourable opinion of the REC (Ref 14/LO/0360).

EWI was performed using a P4-2 phased array transducer (Phillips ATL) with a VantageTM 256 research ultrasound system (Verasonic Inc.). An US sequence composed of a 2 second B mode followed by 4 seconds 2,000 FPS single diverging wave was acquired in 6 apical views and simultaneous ECG acquisition. The displacement estimation was performed on the RF signal from each probe element with 1D axial cross-correlation followed by a least square estimator. Local electromechanical activation was defined as the time point of the downward zero crossing (ZC) on the incremental axial strain. For each view, 200–250 ZCs on manually selected strain curves were annotated on a segmented B-mode mask. Activation times in milliseconds were colour-coded to generate isochronic maps.

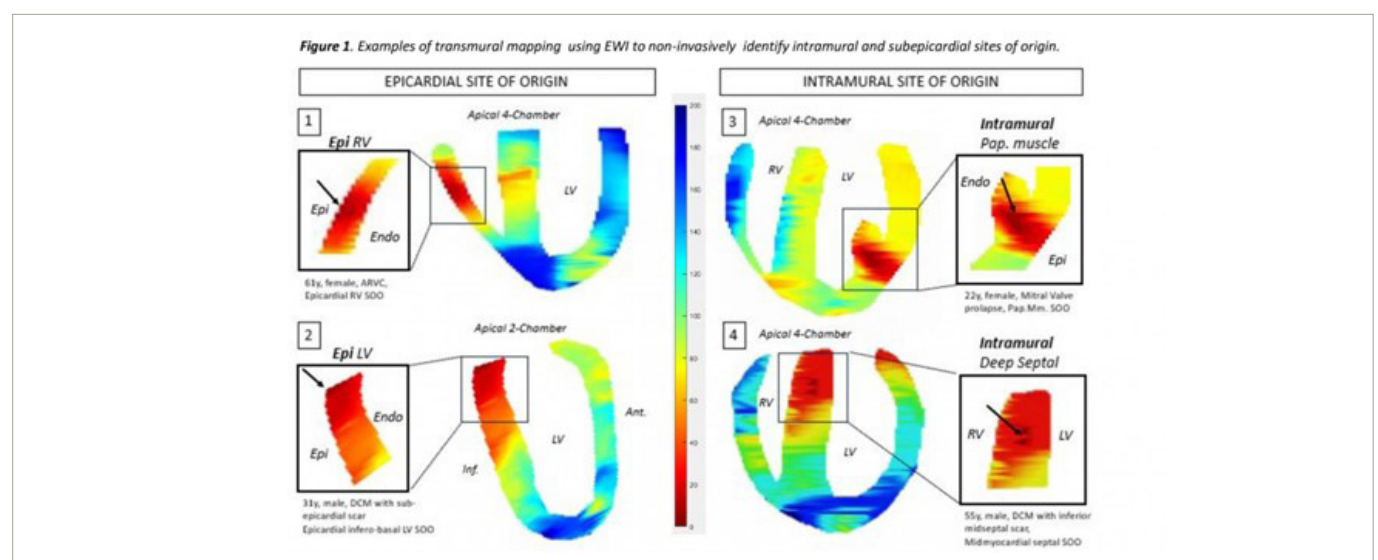
Site of earliest activation in contact mapping and successful ablation was defined as ground truth for VE SOO. Epicardial origin was confirmed by direct epicardial mapping or suspected if, endocardially,

no pre-QRS activation and/or broad early area with r wave in unipolar EGMs was observed. Septal intramural SOO was confirmed by venous mapping or suspected based on combined right and left ventricular activation mapping features. Papillary muscle origin was defined based on anatomical location (supported by co-registered CT model), typical pleomorphic VE morphologies with subtle changes and multiple exit sites (no intramural mapping data to confirm precise SOO available for these sites).

Results: Eleven patients with VE were enrolled (54.5% male, age 39 ± 17.4 years, 64% structural heart disease with LV EF $43 \pm 16\%$ and 50% LGE+ in MRI). Total VE burden was $26.2 \pm 9.2\%$. Seven patients had one prior ablation attempt. Contact mapping identified the SOO as subepicardial in 3 (ARVC with RV epicardial SOO, LV summit, DCM with epicardial infero-basal LV SOO), deep intramural septal in 2, LV papillary muscle in 4, right aortic cusp in 1 and endocardial mid RV free wall in 1. EWI correctly identified all (sub)epicardial (3/3) and intramural septal (2/2) SOOs. Three papillary muscle VEs were mapped to the base/intramural segment of the papillary muscle and 1 to the midmyocardium in the adjacent LV wall segment. The aortic cusp VE was mapped to the LVOT. The patient with endo RV VE had insufficient VEs for EWI mapping at two attempts. Representative examples of EWI localization maps are shown in Figure 1.

Conclusion: EWI successfully identified intramural and subepicardial origin of focal ventricular arrhythmias independent of presence of scar. This promising, non-invasive and radiation-free echocardiography-based mapping modality has the potential to guide preprocedural planning including requirement for epicardial access and/or advanced ablation setup and technology (e.g. bipolar, ethanol). □

Figure 1: Examples of transmural mapping using EWI to non-invasively identify intramural and subepicardial sites of origin





Moderated Posters 1

41/The quality of life, symptoms and experiences of patients with an elevated body mass index undergoing catheter ablation for atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr41

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Atrial fibrillation (AF) is the most common arrhythmia seen in clinical practice. Previous studies have demonstrated that AF may result in high symptom burden and reduced quality of life (QoL). Rhythm control in the form of catheter ablation has become an established treatment option for AF. Certain risk factors are associated with the development and progression of AF, notably, an elevated body mass index (BMI). Emerging evidence suggests that risk factor modification in the management of AF is an important component of the patient pathway. Previous studies concerning the influence of a raised BMI on patient-reported outcomes after ablation have been contradictory. Qualitative research in this area has been limited.

Aim: This study aimed to explore the quality of life, symptoms, and experiences in patients with an elevated BMI undergoing catheter ablation for AF.

Methods: This was a single centre, mixed methods cohort observational study of patients with a BMI ≥ 25 who were eligible for first-time AF ablation. All eligible patients over a 9-month period were invited to take part. Quality of life and symptoms were assessed before ablation and at 3 and 6 months afterwards, using the SF-36 and Patient Perception Questionnaire, which are both validated tools previously used in this patient population. Multiple regression models were used to identify predictors for improvements in two of the QoL domains (vitality and general health) after ablation. Independent variables which included age, gender, BMI at baseline, classification of AF, left atrial volume index and rhythm control at 6 months were added to the regression model. At 6 months post-ablation semi-structured interviews were undertaken to establish the patient experiences in this context.

Results: Eighty-eight invited patients agreed to take part and 82 of those completed the study. The 6 that were excluded had left atrial appendage thrombus on the day of the ablation or did not complete follow-up. A significant improvement was seen in all domains of quality of life after ablation ($p < 0.0005$). Symptom-burden also significantly improved at 3 and 6 months after ablation ($p < 0.0005$). Multiple regression analysis demonstrated the only predictor of improved vitality and general health in QoL measures was rhythm control at 6 months. Thematic analysis of participants experiences revealed 4 themes: personal well-being related to AF, care and treatments of AF, interplay of lifestyle and AF and living with AF in a pandemic.

Conclusion: This study has demonstrated that, despite a raised BMI, patients report significant QoL and symptomatic improvements after AF ablation. Furthermore, in this cohort a multiple regression analysis demonstrated that it is rhythm control at 6 months that predicts improvements in vitality and general health components of the SF-36. Patient experiences commonly include personal well-being related to AF, care and treatments of AF, interplay of lifestyle and AF and living with AF in a pandemic. Overall, this study suggests that patients with a raised BMI have positive outcomes after catheter ablation for AF and that rhythm control is the most important factor of improved quality of life. Furthermore, patient experiences of the AF diagnosis are challenging, ablation treatment is positive and lifestyle factors play an important role in looking to the future. □



Moderated Posters 1

42/Understanding the role of blood groups and Rhesus status in patients with heart failure with cardiac resynchronization therapy*European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr42*

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Introduction: The relationship between ABO blood group and Rhesus status with survival outcomes in patients with heart failure (HF) managed with CRT-P/D remains unclear. Understanding this association could provide valuable insights for developing innovative therapeutic approaches, guiding risk-stratification methods, and predicting clinical response to treatment. This retrospective single-centre observational study aimed to evaluate the role of ABO blood group and Rhesus status in patients with HF with CRT-P/D.

Methods: A total of 499 patients with HF who received successful CRT-P/D implantation were included in this study. Patients were followed-up for a median of 4.6 years (IQR: 2.3–7.5) after CRT-P/D, with over 10% of patients having follow-up ≥ 10 years. The primary endpoint was a composite of all-cause mortality and/or heart transplantation/LV assistant device. Sub-analyses were conducted for device indication (primary versus secondary prevention), device type (CRT-P versus CRT-D), and underlying HF aetiology (ischaemic versus non-ischaemic). The NHGRI-EBI Catalog of human genome-wide association studies (GWAS-Catalog) was searched for reported associations with clinical traits and the ABO and Rhesus gene. The Drug Gene Interaction Database was searched for druggability status and the presence of targeting drugs.

Results: The mean patient age was 66.4 ± 12.8 years with a LVEF of $29 \pm 11\%$. Patients were grouped according to blood group (O, A, B,

and AB) and Rhesus status (Rh-positive and Rh-negative). There were no baseline differences in age, gender, or cardioprotective medication. On multivariate analysis, female gender (HR: 0.74 [0.56–0.98] $p=0.038$), LVEF (HR: 0.98 [0.97–0.99] $p<0.001$), QRS ≥ 150 ms (HR: 0.51 [0.40–0.66] $p<0.001$), and Egfr ≥ 60 ml/min (HR: 0.62 [0.47–0.82] $p<0.001$) were significantly associated with reduced all-cause mortality and/or heart transplant/LVAD. In addition, Rh-negative blood group was associated with significantly greater survival (HR: 0.68 [0.47–0.98] $p=0.040$), while no association was observed for the ABO blood group (HR: 0.97 [0.76–1.23] $p=0.778$). There was no significant interaction with prevention, disease aetiology, and presence of defibrillator. Additionally, our search identified Rhesus-related genes to be associated with erythrocyte and platelet function, as well as cholesterol and glycated haemoglobin levels. Four drugs under development targeting the RHD gene were identified (rozrolimupab, roledumab, atorolimumab and morolimumab).

Conclusion: Rh-negative blood group was found to be an independent predictor of improved survival in patients with HF and CRT-P/D. To our knowledge, this is the first report of such an association, indicating the need for further investigation into the underlying Rhesus-associated mechanisms and the development of drugs targeting these pathways. These findings may ultimately align with the paradigm of precision medicine and genotype-guided treatment in the management of HF. □

Moderated Posters 1

43/A non-physician outpatient implantable loop explant service is safe and efficient: The OLE audit

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr43

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Introduction: Over the past 10 years, the indications for implantable loop recorder (ILR) have broadened and the device size has reduced substantially. The implant procedure has moved from the physician-led catheter-lab environment to non-physician-led outpatient procedures. ILR explant procedures have not transitioned in parallel. We implemented a non-physician, outpatient ILR explant service in 2021 and hypothesized that the new explant method of a non-physician explant service performed in outpatients would have comparable safety outcomes and procedural times.

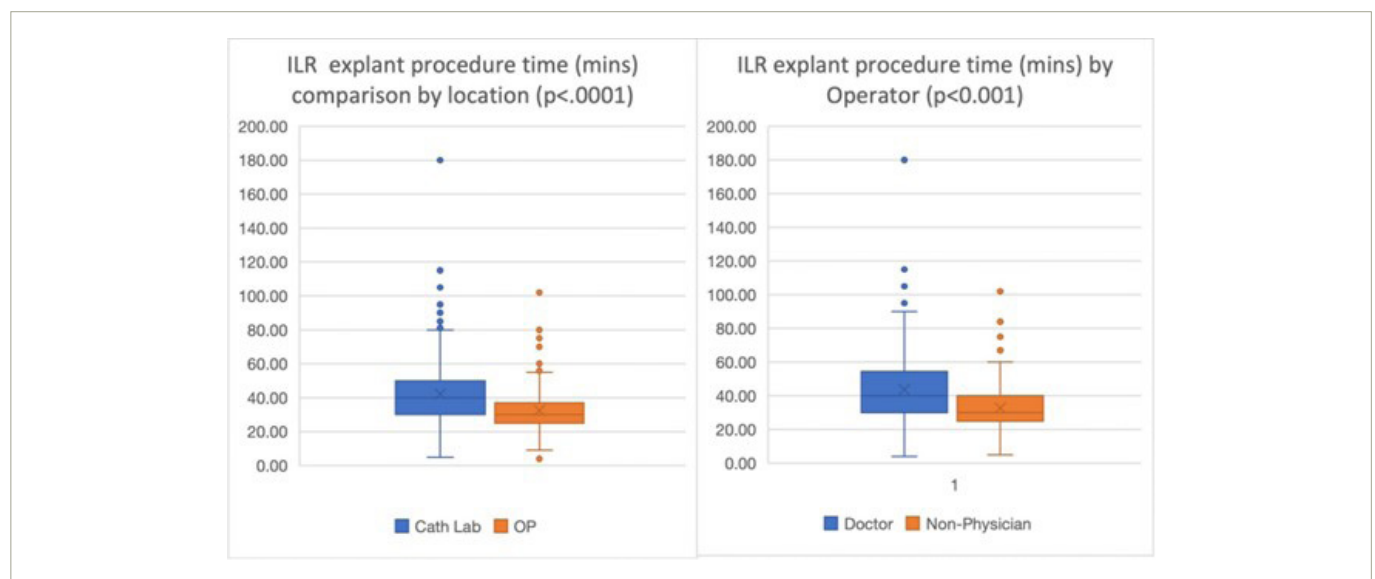
Methods: Patients over the age of 18 undergoing and ILR explanation during the period of July 2016 to January 2023 were included. Data was collected prospectively at the time of explant and during patient follow up 1 week post procedure. Written consent for the procedure was obtained for all patients. The study was registered and approved by the Clinical Effectiveness Unit at Barts Heart Centre (ID: 13317).

Procedures were performed in an outpatient clinic room with a member of clinical support team or nursing assistant assisting the procedure. Wound closure was at discretion of the explantor with an option of wound closure strips or dissolvable sutures. No patients were asked to withhold medications prior to procedure, and post procedure, patients were asked to wait 20 minutes in the shared waiting area to ensure no bleeding complications occurred. Like ILR implant procedure, sterile gloves are worn without the requirement of a surgical gown to reduce stress for the patient.

Results: Seven hundred and forty-two patients were included during the study period with 594 (80%) being performed in the catheterization lab and 504 (68%) being performed by doctors. Four (0.5%) late complications were noted; all these patients' procedures were performed in the catheterization lab by doctors. These late complications were 2 wound infections and 2 stitch protrusions that required re-intervention. ILR procedures performed in the catheterization lab were significantly longer procedures, and significantly shorter when performed by non-physicians.

Conclusions/implications: This study has shown that ILR explants can be performed safely in an outpatient setting by non-physicians, with an improvement in procedural time. This study did not include time in the hospital, which would have been significantly longer due to admission and 'recovery' post-procedure. The outpatient model only utilises a 20-minute waiting time, that is self-directed by the patient in a shared waiting area post procedure. Reasoning for the procedure time being significantly shorter could be due to the number of operators that were performing the procedures in each group. Over 100 operators performed procedures in the doctor group with only 5 non-physicians. This 'sub-specialization' of a lower volume of operators for specific procedure could provide consistency and improve efficiencies. ILR explant procedures being performed by non-physicians enables them to carry out more complex procedures, such as pacemakers. □

Figure 1



Moderated Posters 1

44/Feasibility and safety of left bundle branch area pacing in a district general hospital

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr44

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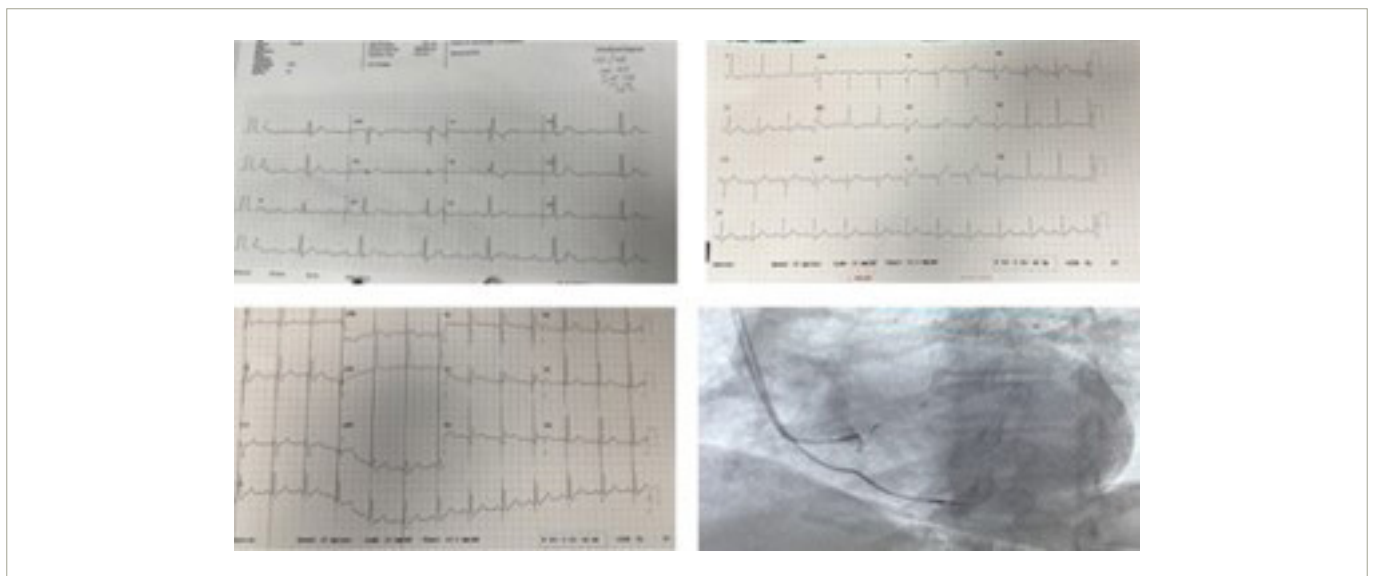
Background: Conduction system pacing is a novel pacing technique that aims to maintain physiological activation of the ventricles. It can be achieved by pacing the His-bundle or the left bundle branch area. Left bundle branch area pacing (LBBAP) has many advantages over His-bundle pacing including being technically easier and having more stable and lower thresholds. It may have the potential to become the predominant form of pacing for bradyarrhythmias and perhaps for cardiac resynchronization therapy. However, its use has only been studied in high-volume, tertiary centres and real-world experience in smaller hospitals is unknown. We present our real-world experience of LBBAP in a busy district general hospital.

Method: Patients underwent LBBAP if they had a bradycardia indication for pacing, but not if they met criteria for cardiac resynchronization therapy. Implant data and any acute complications were recorded. LBBAP capture was assessed according to previously defined criteria, briefly; during unipolar-tip pacing, there was evidence of right bundle branch morphology in lead V1, a constant V6 peak left ventricular activation time of <80 ms at 5 V and 1 V, or a transition from non-selective to selective left bundle branch capture at near-threshold outputs. The procedure was undertaken using 3830 Medtronic or Ingevity plus Boston leads.

Results: LBBAP was attempted in 14 patients: 75 ± 11 years, 79% male, left ventricular ejection fraction of $49 \pm 6\%$ and intrinsic QRS duration of 111 ± 22 ms. The indication for LBBAP was high-degree atrioventricular block in 71% of patients and sinus node disease in 29%. Thirteen cases resulted in successful LBBAP according to the pre-defined criteria, but in 1 case we were unable to achieve LBBAP capture, so a conventional endocardial right ventricular lead was implanted. The mean fluoroscopic time was 20 ± 9 minutes and radiation dose of 84 ± 22 cGy/cm². The paced QRS duration was 109 ± 16 ms, R wave sensing was 14 ± 6 mV and pacing thresholds were ≤ 1 V at 0.4 ms in all cases. There was no significant difference in the paced and intrinsic QRS duration ($P=0.944$). The pacing parameters remained stable at the post-implant check and there were no major or minor acute complications.

Conclusion: Our initial experience with LBBAP shows it can be effectively carried out in a district general hospital without the need for a dedicated electrophysiological haemodynamic system. Further studies are needed to assess its overall safety and clinical utility for different pacing indications. □

Figure 1: A) ECG intrinsic rhythm- CHB, B) ECG in bipolar pacing, C) ECG in unipolar pacing, D) fluoro-image/septogram showing lead position in LAO 30





Moderated Posters 1

45/Proof of concept: Performing both His Bundle and left bundle branch area pacing in the same patient

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr45

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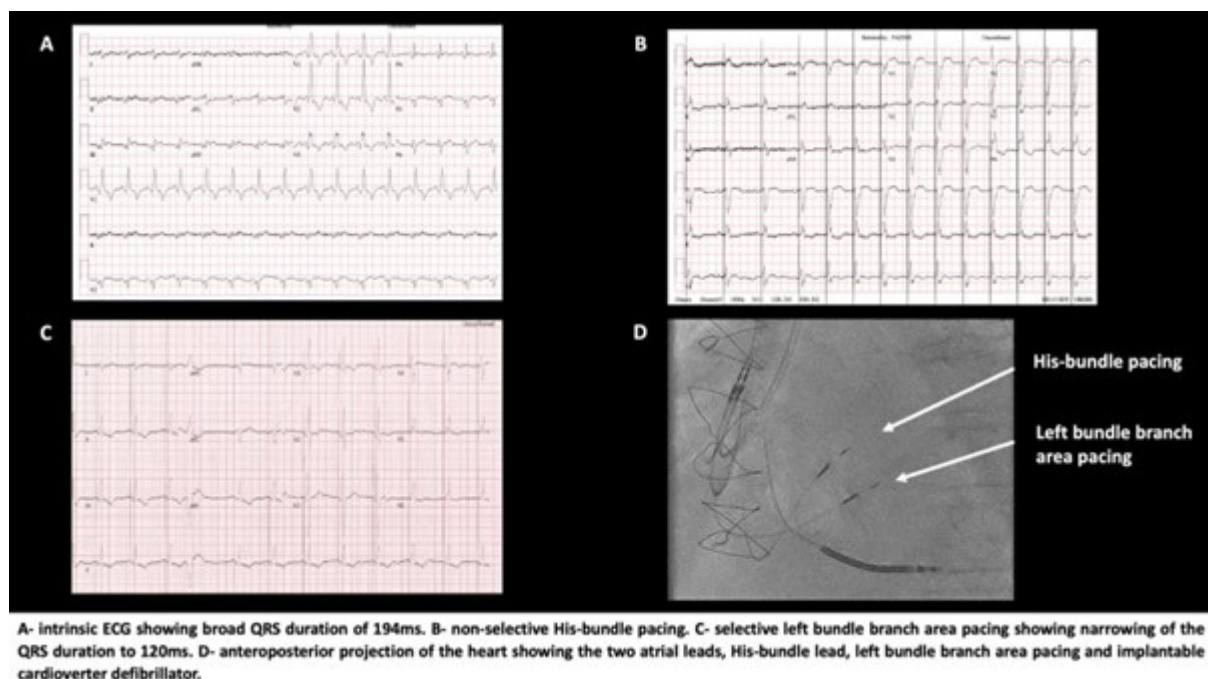
Background: Conduction system pacing has the potential to offer improved outcomes compared with other forms of pacing. His bundle pacing (HBP) can be technically more difficult to achieve and pacing thresholds can be unreliable compared with left bundle branch area pacing (LBBAP). There are no reports describing the feasibility of performing both procedures in the same patient and here we present a unique case report demonstrating its feasibility, as a proof of concept and highlight some important learning points.

Case: A 67-year-old patient with a history of ischaemic heart disease, coronary artery bypass grafting and mitral valve replacement was referred for primary prevention implantable cardioverter defibrillator. He had first-degree heart block of 230 ms with a QRS duration of 122 ms and severe left ventricular systolic impairment 26%. It was felt that he may require pacing, and after discussing at the multi-disciplinary meeting, he underwent HBP with an atrial lead and implantable cardioverter defibrillator as part of the HOPE-HF trial. The procedure resulted in non-selective His capture, with a threshold of 2.2 Mv at 1 ms. Following implantation, he felt less breathless, but his left ventricular systolic function remained similar at 29%. Four years later, he had episodes of paroxysmal atrial tachycardia with a rapid ventricular response and rate control was proving to be difficult. In addition, his His-bundle threshold increased to 3.5 Mv at 1 ms and a generator replacement was

required due to premature battery depletion. He now had broad right bundle branch block of 194 ms and a venogram showed an occluded left subclavian vein. His case was discussed at the multi-disciplinary team meeting at length and given his multiple co-morbidities it was felt transvenous lead extraction was too high risk and he no longer needed an ICD due to his poor prognosis. Given the difficulty with rate control, the consensus was to attempt LBBAP from the right side resulting in more physiological activation with a narrower QRS duration, abandon the left-sided implant and then undergo an atrioventricular nodal ablation in future. A Medtronic 3830 lead was implanted and LBBAP was achieved using previously defined criteria; right bundle branch morphology and a constant V6 peak left ventricular activation time of <80 ms at 5 V and 1 V or transition from non-selective to selective left bundle branch capture at near-threshold outputs. The sensing was 20 Mv, threshold 0.5 V at 0.4 ms and final paced QRS duration was significantly lower at 120 ms. There were no acute complications and the patient improved symptomatically.

Conclusion: Conduction system pacing has many advantages and may become the predominant form of pacing. We have demonstrated that LBBAP is possible in a patient with HBP and this led to greater physiological activation. Although LBBAP is technically easier than HBP, implantation from the right side was more challenging requiring greater guide support to be successful. □

Figure 1





Moderated Posters 1

46/High-density atrial tachycardia mapping in patient with tetralogy of Fallot using a novel multipolar catheter

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr46

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Background: Patients with adult congenital heart disease (ACHD) are more prone to atrial arrhythmia, which increases their morbidity and mortality and risk of hospital admissions when compared with the same population where atrial arrhythmias are absent.

Objective: Compare the use of OCTARAY™ to PENTARAY™ for atrial tachycardia mapping in a patient with ACHD to understand the utility of this novel mapping catheter in mapping complex substrate.

Methods: We describe the case of a 54-year-old female with tetralogy of Fallot, who underwent full surgical repair in 1972 with implantation of an endocardial pacemaker in 1997 for complete heart block. The patient was first reviewed in our emergency ACHD clinic following hospital admission with worsening symptoms associated with tachycardia. Device interrogation confirmed atrial tachycardia (AT) with a cycle length (CL) 280–285 ms.

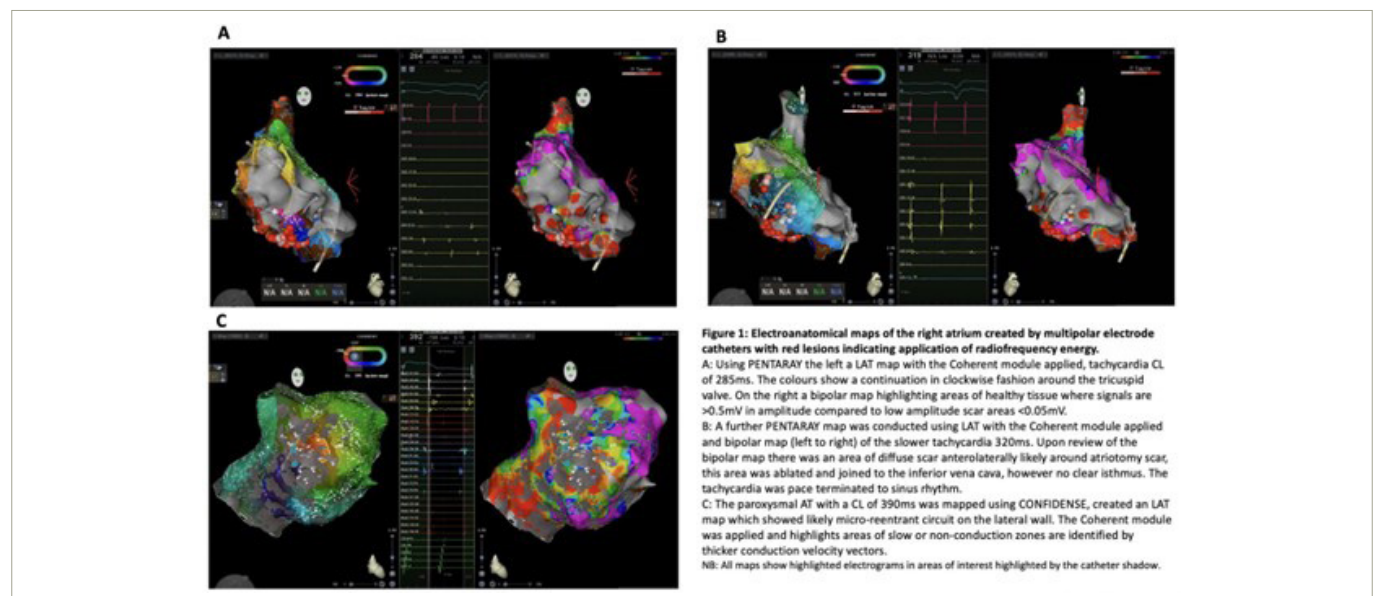
The patient was admitted for percutaneous catheter ablation in July 2020. A fixed curve decapolar catheter was placed in the right atrial appendage and entrainment confirmed cavotricuspid isthmus (CTI) dependent tachycardia CL 270 ms. Electroanatomical mapping was performed using CARTO and CONFIDENSE filtering with a PENTARAY catheter. Bipolar scar thresholds and noise level were set to 0.02 Mv. 6,374 points were collected over 16 minutes (Figure 1A). Radiofrequency (RF) ablation was performed between 30–40 W and slowed tachycardia to 320 ms, but did not terminate and therefore remapped. A low voltage region was identified anterolaterally likely involving atriotomy scar and 5,380 points were collected over 18 minutes (Figure 1B). This area was ablated and joined to the inferior vena cava.

The patient remained arrhythmia-free until May 2022 with recurrence of paroxysmal AT, CL 380–400 ms. A delectable decapolar catheter was placed in the RAA and burst pacing induced tachycardia CL 380 ms. Activation mapping was performed using the OCTARAY catheter and CONFIDENSE filtering. Bipolar scar threshold and bipolar noise level set at 0.03 Mv and 0.02 Mv; 16,863 LAT points were collected in 12 minutes (Figure 1C). LAT and coherent maps highlighted a micro re-entrant circuit on the lateral wall, at the atriotomy site with a potential gap in the intercaval line. RF ablation at 35 W in this area terminated tachycardia in 4 seconds. The patient remains arrhythmia-free 10 months later.

Results: Upon review of these two procedures, we saw reduced mapping time and greater point density with the Octaray mapping catheter. Another distinct benefit is the smaller electrode size and tighter spacing for better delineation of heterogeneous scar on bipolar maps. Moreover, the Octaray provided wide coverage of the enlarged atrial surface to help make immediate diagnoses of activation patterns and identification of critical isthmus, when placed at the area of interest. The Octaray catheter also allows the use of TRUEref, this technology uses a unipolar electrode to reduce the impact of far-field signals. Consequently, aiding the identification of gaps and improving the characterization of the lesion sets, homing in on the critical isthmus with less ablation necessary to terminate arrhythmia.

Conclusion: The OCTARAY™ catheter provides excellent signal quality and identification of critical isthmus with quick mapping time, making it an attractive option in the ACHD population where arrhythmias are often non-sustained or not tolerated. □

Figure 1: Electroanatomical maps of the right atrium created by multipolar electrode catheters with red lesions indicating application of radiofrequency energy





Moderated Posters 1

47/Atrial fibrillation detection post cryptogenic stroke: Overall diagnostic yields of implantable loop recorders and conventional ambulatory monitoring

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr47

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Introduction: Cryptogenic stroke (CS) accounts for 30–40% of all ischaemic strokes and there is substantial evidence to suggest arrhythmogenic cardioembolic involvement following the development of atrial fibrillation (AF). CS related to AF are often devastating, with around 70% mortality or significant disability. CS recurrence in the context of AF can be reduced with initiation of anticoagulation therapy. AF can occur in paroxysms and may not always be present at the time of stroke presentation and therefore go undetected with 12-lead ECG monitoring. Traditionally, ambulatory monitoring was used to detect AF post CS; however, CRYSTAL-AF demonstrated that prolonged cardiac rhythm monitoring using an implantable loop recorder (ILR), can uncover a substantial proportion of stroke patients with AF that would otherwise not be detected by conventional short-term ambulatory monitoring. A clear multidisciplinary pathway has been established at University Hospital of North Midlands for CS patients to access ILR monitoring.

Aims: The aim of this study is to determine the diagnostic yields for the detection of AF following CS, when using ILRs compared to ambulatory monitoring.

Objectives:

- Calculate the incidence of AF detection post-CS with the utilization of ILRs.

- Calculate the incidence of AF detection post-CS with the utilization of ambulatory monitoring.
- Calculate the difference in AF detection post-CS with the utilization of ILRs when compared to ambulatory monitoring.

Methods: A retrospective observational study was conducted in a single tertiary centre in the UK. Local electronic dating reporting systems were used to review baseline characteristics and clinical outcomes between January and December 2021.

Results: A total of 843 patients underwent post-CS monitoring for the detection of AF. Seven hundred and forty-one patients received ambulatory monitoring of up to 72 hours in duration. One hundred and two patients received an ILR, and a positive diagnostic yield of atrial fibrillation was detected in 28 patients with ambulatory monitoring (3.78%) and 16% of patients in the ILR group ($p < 0.001$).

Conclusion: This study provides an up-to-date review of contemporary practice in the detection of AF post CS, and supports the findings of the existing literature that ILRs significantly increase the detection of AF post CS, when compared with conventional ambulatory monitoring. □



Moderated Posters 1

48/Co-producing a complex self-management support intervention for people with postural tachycardia syndrome (SSPoTS): The co-design and co-refining workshops

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr48

Authors: HR Eftekhari (Presenting Author) – University of Warwick and University Hospitals Coventry and Warwickshire, Coventry, UK; G Pearce – Coventry University, Coventry, UK; S Staniszewska – University of Warwick, Coventry, UK; K Seers – University of Warwick, Coventry, UK

Introduction: Crucial for future healthcare delivery is supporting people in self-management. Postural tachycardia syndrome (PoTS) is considered to be underdiagnosed and under-treated, yet has a high impact on disability and quality of life comparable to other long-term conditions. This study addresses the gap for a PoTS-specific supportive self-management programme. The aim was to co-design and co-refine the SSPoTS intervention utilising co-production methods.

Methods: The three Co's framework underpins the programme of research. The first phase of co-refine has been previously carried out through in-depth interviews (n=44) to understand potential intervention components from people with PoTS (n=19) and healthcare professionals (n=25). Potential intervention components from the first phase were mapped to the PRISMS taxonomy of self-management support. In workshop one, phase 2, six priorities were co-designed for the SSPoTS intervention manual. The broad descriptors and rationales are:

- education about PoTS and clinical management – the key to empowering people is education and understanding PoTS;
- PoTS lifestyle advice – lifestyle advice and learning methods of adherence form the cornerstone of PoTS management;
- validation of PoTS experiences – experiences of poor PoTS healthcare and support mechanisms are widespread;
- reliable resources – people with PoTS want reliable PoTS;
- psychological support – PoTS is often a long-term condition requiring psychological adjustment; and
- communication with social networks – living with PoTS can be isolating.

This study reports phase 2: co-refining of the intervention manual through consensus methods.

University of Warwick sponsorship and HRA ethical approval was gained. Purposive sampling was used to recruit people with PoTS from the PoTS UK charity (n=9), charity representative (n=1), health care practitioners (n=1) and SSPoTS public and patient advisory board representatives (n=2).

The SSPoTS phase 2 co-refining workshop was facilitated online for 3 hours. Discussion focused on refinement of the co-designed manual circulated for review prior to the workshop. Consensus was sought utilising the nominal process' four step method and rank scoring:

- generation of areas for co-refining;
- participants shared one co-refining area each. The process utilised a "round robin" technique, until all potential refinements were identified;
- the group explored the identified refinements in step 2; and
- 4. anonymous voting took place. Each person ranked their top 5 refinement in order from 5 (highest priority) to 1 (lowest priority).

Results: Five areas for manual refinement were identified:

- manual layout: need for improving learning styles through visual aids, sessions' summary tables, user friendly fonts and use of speech bubbles for self-reflection;
- manual format: improve sessions accessibility through informal methods and digital formats;
- intervention components: incorporate caveats on lifestyle changes and a PoTS flare-up action plan;
- intervention delivery: need for micro-breaks supporting reflection and participation; and
- supportive mechanisms: facilitate resources for further support at programme close.

Conclusions: This is the first evidence-based intervention being co-produced to support the self-management of people with PoTS. The SSPoTS manual will now be feasibility tested in phase 3 with a focused process evaluation. □



Moderated Posters 1

49/Switching of warfarin to DOACs in patients with atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr49

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Background: The National Institute for Health and Care Excellence (NICE) guidelines for atrial fibrillation (AF) diagnosis and management 2021 recommends offering patients with AF and a CHA₂DS₂VASc >2 anticoagulation with a direct-acting oral anticoagulant (DOAC) first line where appropriate for stroke prevention. For patients on vitamin-K antagonists, their anticoagulation control is assessed according to time in therapeutic range (TTR). Patients with a TTR<65% have been shown to have an increased risk of hospitalization, mortality, and thromboembolic events and as such should have anticoagulation strategy reassessed.

Objective(s): To identify and evaluate patients on warfarin for AF, with a poor TTR, for safe switching to DOAC therapy to reduce potential risk of bleeding and thromboembolism.

Method: A specialist cardiovascular pharmacist contacted anticoagulation clinics in 3 boroughs to identify patients currently being treated with warfarin for AF (target INR 2–3) with a TTR<65%. These patients were reviewed for suitability for a switch to a DOAC using the Royal Pharmaceutical Society (RPS) guide for safe switching of warfarin to DOACs. If patients were deemed suitable, they were contacted by a member of the primary care multidisciplinary team (MDT) to discuss their

poor TTR and possibility of switching to a DOAC. If agreeable, patients were switched from warfarin to DOAC. All patients were followed up 1 month after initiation to assess for adherence and tolerability to the new therapy. This study did not require ethics approval.

Results: Between February 2023 and May 2023, 796 patients with AF across 3 boroughs were being treated with warfarin. A total of 9% (74/796) of patients treated had a TTR <65% and 66% (49/74) of these patients were deemed suitable for a switch, whilst the remaining 33% (25/74) were unsuitable. This was due to variety of factors including creatinine clearance <15 ml/min, extreme body weight, medication interactions and patients declining to switch. A total of 45% (22/49) of patients were successfully switched to a DOAC, whilst the remaining 55% (27/49) are in process of being switched over to a DOAC. Patients' anticoagulation clinics were also informed of the switch.

Conclusions: Active monitoring of TTR on a regular basis, in addition to specialist cardiovascular pharmacist input into the primary care MDT, has facilitated in a safe and effective transition from warfarin to DOAC therapy to improve patient safety. □

Moderated Posters 2

50/Pre-procedural cardiac computer tomography and magnetic resonance for ventricular tachycardia catheter ablation: A UK single-centre experience

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr50

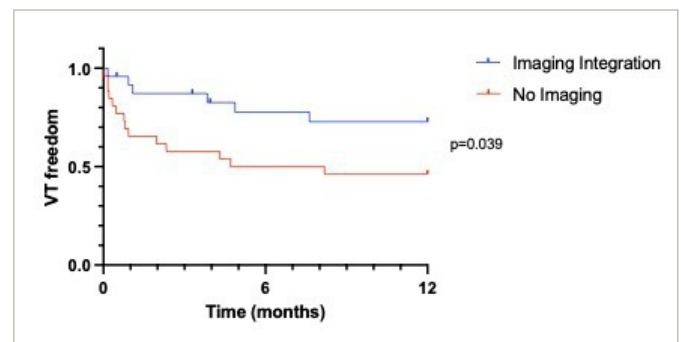
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Background: Catheter ablation is an effective therapy for ventricular tachycardia (VT) secondary to ischaemic heart disease (IHD), but its wider adoption is limited by procedure complexity and safety. Pre-procedural planning with cardiac computer tomography (CT) or magnetic resonance (MR) and their integration into electro-anatomical mapping (EAM) during ablation have sought to address some of the associated challenges. The aim of this study was to investigate the impact of pre-procedural cardiac CT or MR on VT catheter ablation outcomes in patients with IHD.

Methods: Fifty-five patients with IHD who underwent VT substrate ablation in our centre from 2013–2019 were included in this retrospective analysis. Baseline characteristics and procedure details were compared between patients who underwent 3D-reconstructed imaging-guided ablation (n=25, 88% cardiac CT, 12% MR) and those with no imaging (n=30). Technical, immediate clinical and longer-term outcomes were then explored.

Results: Fluoroscopy dose reduced over time in procedures with imaging integration ($r=-0.51$, $p=0.01$), but not in those without ($r=-0.27$, $p=0.22$). There was no difference in procedure time, acute complication rate or VT inducibility after ablation between the 2 groups. VT freedom after 12 months was higher in imaging-guided ablations compared with no pre-procedural imaging (log-rank 0.039) (Figure 1). After excluding

Figure 1



deaths within 12 months, 42% of patients with no pre-ablation imaging had a repeat procedure during this timeframe, while none in the imaging-guided group did.

Conclusion: Integration of cardiac CT or MR with electro-anatomical mapping is associated with a higher rate of VT freedom. With increasing experience, use of imaging reduces the dose of radiation required during substrate ablation. □



Moderated Posters 2

51/Associated risk, safety and long-term outcomes for patients with cardiac implantable electronic devices undergoing radiation therapy

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr51

Authors: J McIntyre (Presenting Author) – University Hospital North Midlands NHS Trust, Stoke-on-Trent, UK

Background: Radiation therapy (RT) is a standard modality for cancer treatment for patients with cardiac implantable electronic devices (CIEDs). The increased ageing population has influenced the number of patients receiving radiation therapy, and concurrently the number of patients undergoing implantation of CIEDs. Identification of risk factors and safety concerns for RT to CIEDs must therefore be addressed.

Objectives: To determine the incidence of device malfunction and categorize severity from associated risk factors. To assess long term clinical outcomes.

Methods: A retrospective observational study was performed using local electronic patient record systems to review baseline characteristics and clinical outcomes. Descriptive statistics were performed to determine outcomes.

Results: One hundred and twenty-two patients were referred for RT and CIED follow up over a 42-month period. Twenty-two patients were discounted due to a change in treatment or no follow up data. Four patients had devices extracted, with 2 re-implanted in the right pectoral region, leaving 95 total patients undergoing 98 treatment periods. Regions of RT were split into head and neck: 11 (11%), chest: 48 (49%) and below abdomen: 39 (40%). CIEDs encompassed permanent pacemaker (PPM) (57%), cardiac resynchronization therapy-pacemaker (CRT-P) (12%), implantable cardioverter defibrillator (ICD) (9%), cardiac resynchronization therapy-defibrillator (CRT-D) (10%), leadless pacemaker

(1%) and implantable loop recorder (ILR) (9%). Forty-nine (50%) patients were deemed higher risk (pacemaker dependant, ICD in situ or individual treatment does > 5 Grays [Gy]). Average cumulative RT dose was 39.5 Gy, with an average individual dose of 3.9 Gy. Seventy-two patients (73%) were followed up via remote monitoring.

There were 3 (3%) acute minor adverse events within the first follow up. All were elevated lead thresholds and resolved within 3 months. Two of these patients (2%) were deemed higher risk, with one having a CRT-D in situ and one being pacemaker dependant. Elevated lead threshold occurred on the right ventricular (RV) lead of the pacing-dependant patient and required a new RV lead at generator change. It was determined this initially occurred prior to starting RT and was unrelated to treatment. One adverse event (1%) occurred in each of the 3 treatment regions. Average cumulative dose and individual treatment dose of patients with complications was 56.7 Gy and 2.3 Gy respectively, compared with 39 Gy and 4 Gy for patients without adverse events. There were no major adverse events over a mean follow up of 311 days.

Conclusion: A robust pathway for surveillance of patients with CIEDs undergoing RT has enabled uninterrupted care with only minor transient adverse events. The use of remote monitoring has enhanced safety and streamlined this care pathway. □



Moderated Posters 2

52/The impact of physiologist-led heart failure management using cardiac device diagnostics and clinical assessment: A case report

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr52

Authors: LR Moore (Presenting Author) – Manchester University NHS Foundation Trust, Manchester, UK; A Domingos – Manchester University NHS Foundation Trust, Manchester, UK

Introduction: Cardiac implantable electronic device (CIED) diagnostics are of significant clinical utility when managing the heart failure (HF) population. This report highlights a novel service in which cardiac physiologists act autonomously upon CIED diagnostics to identify and manage patients at risk of decompensated HF.

Patient presentation: A 71-year-old female with ischaemic heart disease and paroxysmal atrial fibrillation (AF) presented via a remote CIED transmission. The device diagnostics indicated possible decompensated HF and therefore initiated a telephone triage. The telephone review of the patient's symptoms outlined worsening dyspnoea of recent onset and reduced capacity to perform daily activities. An urgent appointment in the physiologist-led clinic was made for a face-to-face clinical assessment.

Initial work up: the physiologist assessment identified bi-basal crepitations, bilateral pitting oedema, a pansystolic murmur and HF symptoms correlating with the onset of AF. Suspecting decompensated HF, an ECG, echocardiogram and blood test were performed within the physiologist service.

Diagnosis and management: 12-lead ECG: The 12-lead ECG showed AF with rapid ventricular response and confirmed the diagnosis of persistent AF highlighted within device diagnostics. The addition of an echocardiogram and blood test were clinically useful in confirming an acute HF exacerbation.

Echocardiogram: prior to presentation, the patient had documented mild mitral regurgitation (MR) and short paroxysms of AF. At the time of clinical assessment, this had worsened to moderate MR. The exacerbation of

the existing MR was attributed to the onset of persistent AF with poor rate control. Imaging using transthoracic echocardiogram confirmed the finding of a pansystolic murmur outlined in the physiologist clinical assessment.

Bloods: urgent blood tests confirmed an elevated NT-pro BNP of 628 pg/ml. The patient received a same-day review by our electrophysiology consultant who supported the physiologist diagnosis of decompensated HF in the context of persistent AF. A medical review of the patient's prescription resulted in a change from carvedilol to bisoprolol and initiation of oral furosemide. The patient was also listed for an urgent pulmonary vein isolation (PVI).

PVI: 4 weeks after the patient was identified to be at risk of an acute HF decompensation through the physiologist-led service, they underwent a successful PVI. This success was initially short lived, with 1.5 days in sinus rhythm post procedure before re-initiation of AF. However, this episode of AF persisted for 1 month before terminating back to sinus rhythm, which has remained ever since.

A repeat clinical assessment performed 6 weeks post-intervention demonstrated no HF signs or reoccurrence of AF.

Conclusion: A physiologist-led HF management service can streamline the time from patient presentation to HF review, potentially reducing the risk of HF hospitalization and improving patient outcomes. Given the appropriate training, physiologists can identify and clinically assess patients at risk of worsening HF and highlight these patients to the necessary services for further management. □

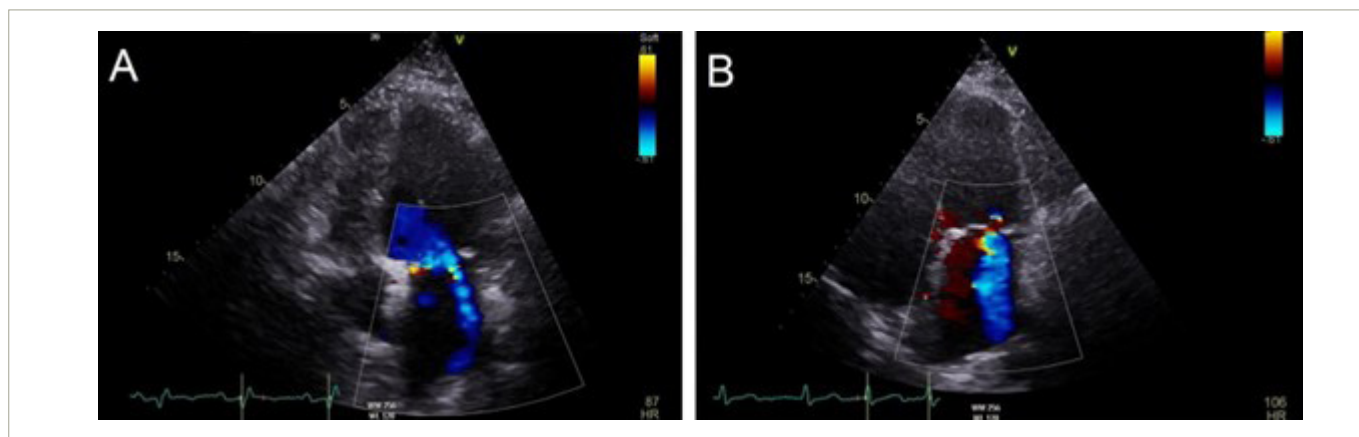
Figure 1: CIED diagnostics outlining increased HeartLogic Heart Failure Index correlating with onset of persistent AF



CONTINUED



Figure 2: Transthoracic echocardiogram images taken in the apical 4-chamber view highlighting mild MR pre-presentation (A) and moderate MR at the time of presentation (B)



Moderated Posters 2

53/Local and systemic infections after cardiac implantable electronic device placement with adjunct taurolidine

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr53

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Introduction: The rate of cardiac implantable electronic device (CIED) placement is increasing. CIED placement comes with complications. CIED infection is a major complication increasing both morbidity and mortality. International guidelines do not recommend the local use of specific antimicrobial agents during implantation because adequate scientific studies supporting their use are not available or not supportive. In this prospective observational study, the infectious complications that occurred after CIED placement performed following a new periprocedural prevention protocol with taurolidine were recorded.

Materials and methods: All participants undergoing CIED placement (including generator substitution, revision with the aim to upgrade or downgrade, early revision, i.e. any procedure accessing the pocket) between 1 January 2020 and 30 November 2022 at 4 European hospitals were consecutively included in the study. Procedures and not the participants were the datasets. During each procedure all hardware (leads, suture sheaths, pulse generator) was treated with an antimicrobial solution containing taurolidine (TauroPace) and the pocket irrigated with the same product. Primary endpoint was major CIED infection occurring within 3 and 12 months after the procedure, while secondary endpoints were all grade adverse events (related to the antimicrobial solution used, the CIED system or the procedure) and all-cause mortality.

Results: Adjunct taurolidine was used in 822 procedures which entered final analyses. Three major CIED infections could be observed during 12 months. Kaplan-Meier estimated event rates were 1/799 (0.125%) at 3 months [0.003–0.695%] and 3/588 (0.51%) at 12 months [0.105–1.48%], respectively. Two major CIED infections were pocket infections with Kaplan-Meier estimated event rates of 0/799 (0%) at 3 months [0–0.461%] and 2/588 (0.34%) at 12 months [0.041–1.220%], respectively.

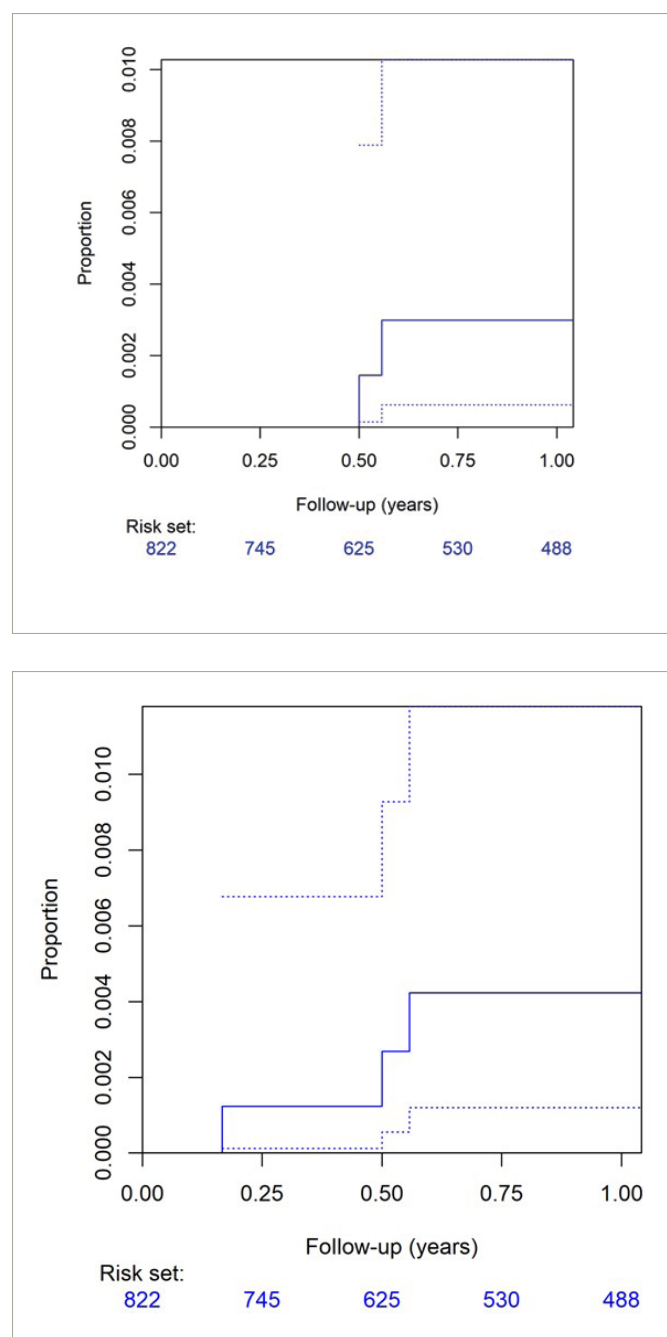
Discussion: Infections are an important and clinically significant complication associated with the placement of a CIED.¹ Current epidemiological data indicate an increasing number of infections with suspicion of underdetection.² Numerous treatments have been proposed to meet this problem with inconsistent results.

Taurolidine is a versatile agent. It is the main active ingredient of an antimicrobial wash designed for disinfecting CIED hardware and the surgical site (pocket). Its active metabolites prevent pathogens from adhering to surfaces, destroying them, preventing biofilm formation and neutralising endotoxins and exotoxins. There is good evidence of the molecule's efficacy at different galenic concentrations in preventing foreign body infections in renal replacement therapy, parenteral nutrition and cytostatic treatment.

Our temporal analysis suggests the clinical utility of taurolidine use for the prevention of CIED infection, particularly pocket infection in a cohort of high-risk patients, showing lower event rates than those reported in the literature.

Conclusions: Taurolidine is safe and effective for the prevention of infectious complications related to the placement of any CIED. □

Figure 1: Cumulative incidence curves for CIED pocket infection (top) and major CIED infection (bottom) by cohort (solid lines) with pointwise confidence intervals (dashed lines)





Moderated Posters 2

54/Examining the key characteristics and range of topics focused on by PoTS literature pertaining to diagnosis, symptomology and treatment: A scoping review

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr54

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Aim: This scoping review examined the key characteristics of empirical research and their clinical implications pertaining to diagnosis, symptomology and treatment across the postural tachycardia syndrome (PoTS) literature field.

Methods: An a priori protocol, article eligibility criteria and peer-reviewed systematic search strategy were first made available on Open Science Framework.¹ The developed search strategy was deployed (initial = April 2019; updated = August 2022) across 5 academic databases from inception – PUBMED, CINAHL, Cochrane Library, Web of Science and ProQuest – to identify PoTS-relevant disseminations from all source types. Article screening and data extraction processes were independently undertaken by 2 reviewers, who demonstrated high inter-rater reliability agreement (Cohen's $K=0.815$; 95% $CI=0.658$; 0.972). Alongside the undertaking of demographical analyses and identification of clinical implications through narrative synthesis, a fifteen thematic-coding framework was also developed to categorize the core focus of empirical works within the final article subset ($N=654$).

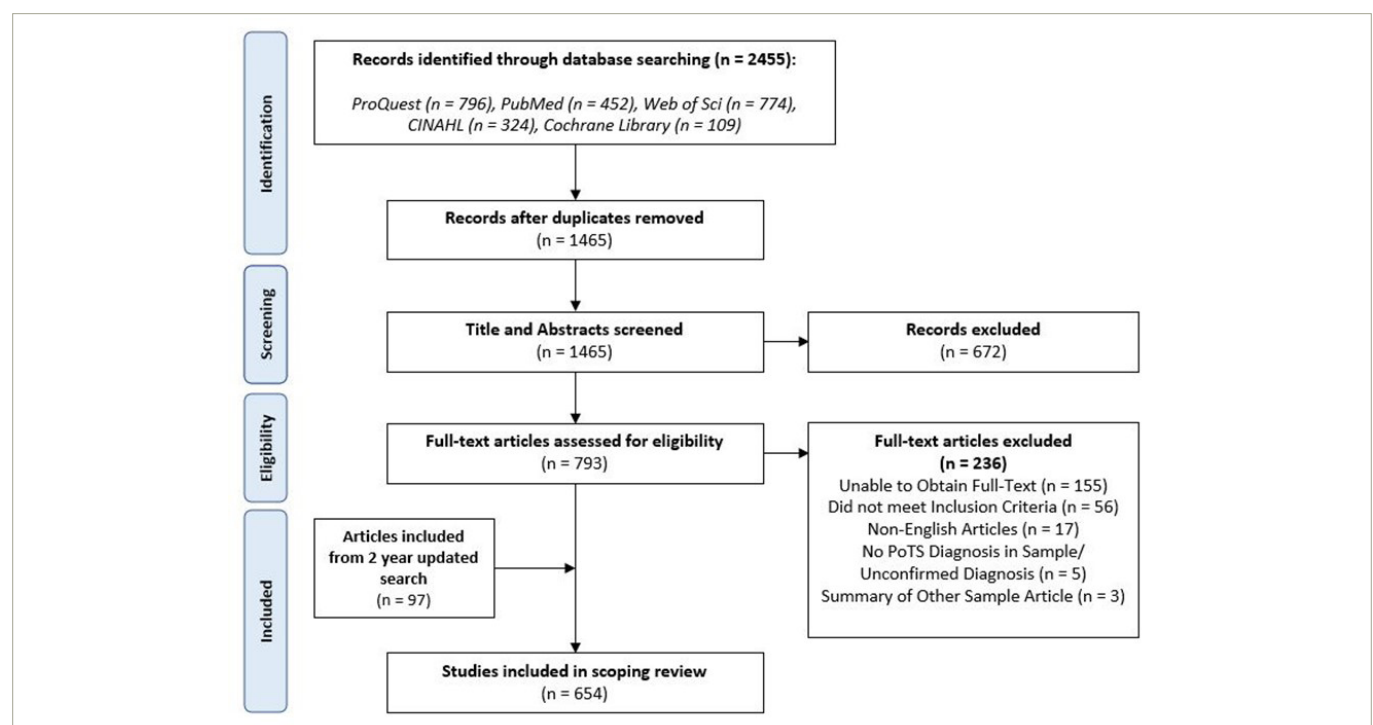
Results: Examination of article indicated a paucity of qualitative research (<1%) identified within the final review sample. PoTS empirical

literature was dominated by works exploring: underlying aetiology (16.8%), paediatrics (14.2%), treatments (12.2%), comorbidities (12.1%) and diagnostic assessments (11.8%). Clinical implications drawn from narrative synthesis recommended the employment of psychometric tools, patient history and physiological markers to support PoTS diagnosis alongside chronic fatigue syndrome (<9 score on both Epworth Sleepiness Scale and Orthostatic Grading Scale), and its differentiation from vasovagal syncope diagnosis (consideration of historic psychiatric diagnosis, heightened norepinephrine levels and plasma H2S levels, examination of daytime ultra-low frequency heart-rate variabilities).

Conclusions: Our review findings highlight an urgent need for additional PoTS qualitative works to be undertaken to develop further understandings behind patients' reported debilitating symptom experiences, poor quality of life and increased suicide ideation scores. Patient co-design qualitative research processes remain critical for supporting the development of novel PoTS interventions and the likelihood of their acceptability within this patient population. □

1. Hogg M. Investigating the characteristics and range of topics focused on by Postural Tachycardia Syndrome (PoTS) literature: A scoping review. 2019. Available at: <https://osf.io/bwa6x> (accessed 7 August 2023).

Figure 1: PRISMA flow diagram for the undertaken scoping review





Moderated Posters 2

55/Standardizing the safe use of continuous cardiac monitoring within the University of Plymouth Hospital's cardiology department: An audit of current practice and introduction of a trust-wide protocol

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr55

Authors: *S Harvey (Presenting Author) – The Southwest Cardiothoracic Centre, Plymouth, UK; S Merson – The Southwest Cardiothoracic Centre, Plymouth, UK; B Sieniewicz – The Southwest Cardiothoracic Centre, Plymouth, UK*

Introduction: Continuous cardiac monitoring (CCM) is vital for observing patients at risk of arrhythmia. It can, however, restrict mobility and increase the risk of falls and delirium in susceptible patients. Its use should therefore be rationalised and regularly reviewed to ensure ongoing monitoring remains indicated.

In our centre, there are currently no guidelines for the use or review of CCM. This represents a barrier to regular, judicious review of patients' ongoing need for monitoring. It may delay removal and prolong monitoring, thus increasing the associated risks. We aimed to standardize practice relating to CCM, to reduce unnecessary monitoring and develop resources promoting safe and consistent use of CCM.

Methods: A retrospective analysis of monitored cardiology patients at our centre. The appropriateness of ongoing monitoring was assessed against 2020 BHRS guidance.¹ The standard of documentation regarding initiation and clinical review of patients' monitoring data whilst in situ was also audited. Quantitative and qualitative survey data was collected from ward nurses to establish prior training and confidence in rhythm recognition.

Results: The notes of 21 monitored patients were reviewed, between 19 October 2023 and 27 October 2023. Of these, 13 (62%) were monitored due to coronary disease, 7 (33%) for arrhythmia, and 1 patient (5%) for non-cardiac disease. When assessed against BHRS criteria, 14 (67%) had a clear indication for ongoing CCM. Only 10 patients (45%) had documentation of the requirement for CCM on the day of initiation. Ten patients (45%) had a documented review of their rhythm data whilst being monitored.

Eleven ward nurses were surveyed during the data collection visits. Of these, 9 (82%) underwent formal training on starting their role, however only 7 (64%) were confident that they had sufficient skill in rhythm recognition to manage CCM. Fifty per cent of those lacking confidence had received formal training and attributed their lack of confidence to deskilling, having been trained several years ago.

Conclusions: These data reflect that a significant proportion of our inpatients are monitored unnecessarily or for longer than required. This has implications for the prioritization of CCM as a finite resource, but also on patient safety, given the associated risks of prolonged monitoring. Suboptimal documentation may be a contributory factor, as the lack of a clear indication for CCM makes assessment for removal challenging. Whilst rhythm recognition training was accessed by the majority of those surveyed, the lack of confidence amongst ward nurses indicates that our current education programme needs refining. Both refresher sessions and educational resources may help limit the deskilling of those trained some time ago. Implications for our department: A trust guideline for CCM has now been developed, highlighting common indications for monitoring with anticipated durations. It emphasizes the importance of clear documentation and regular review, providing a framework against which to assess monitoring for removal. Several resources are under development to complement this, including an online guide for new doctors demonstrating how to operate the central monitoring unit. The department is also expanding monitoring training to offer refresher sessions to experienced nurses and include new doctors at the point of induction. □

1. Hall A, Foley P, Yue A and Schilling E. 2020. British Heart Rhythm Society: Standards for continuous cardiac monitoring in-hospital (telemetry). 2020. Available at: <https://bhrrs.com/wp-content/uploads/2020/09/BHRS-cardiac-monitoring.pdf> (accessed 7 August 2023).

Moderated Posters 2

56/Conduction system pacing as a novel therapeutic approach in ventricular tachycardia: Improving haemodynamics and terminating VT

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr56

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Introduction: Implantable cardioverter defibrillators (ICDs) reduce mortality in people at risk of sudden cardiac death. During ventricular tachycardias (VT), cardiac output is reduced due to fast heart rates reducing diastolic filling time, loss of atrio-ventricular synchrony and loss of bi-ventricular synchrony.

Improving haemodynamic status during VT may allow more time for VT to self-terminate and postpone the need for acutely lifesaving, yet paradoxically harmful therapies in the longer term.

Patients requiring ICDs often have a pacing indication. In those at high risk of developing pacing-induced cardiomyopathy, conduction system pacing is often now preferred over right ventricular pacing, and additionally is rapidly gaining traction for its use as a heart failure treatment.

We assessed the potential benefit of His bundle pacing as a therapeutic approach to improve cardiac output during ventricular tachycardia (VT) and also its ability to terminate VT.

Methods: Patients attending for clinically indicated invasive electrophysiology procedures who experienced clinical VT (either spontaneously or induced with a ventricular drive train and shorter coupled S2 and S3 beats) were recruited. We recorded a continuous 3-lead ECG and beat-by-beat blood pressure (either invasively or non-invasively with a Finometer). After around 15 seconds of clinical

VT, we paced the His bundle at 5 bpm above the VT rate to assess the haemodynamic response. We measured the percentage change in systolic blood pressure during His bundle pacing relative to the systolic blood pressure during clinical VT.

After achieving termination in 2, the protocol was adapted for the final 4 patients to deliver a short burst of His bundle pacing (8–15 beats) at 91% of the tachycardia cycle length.

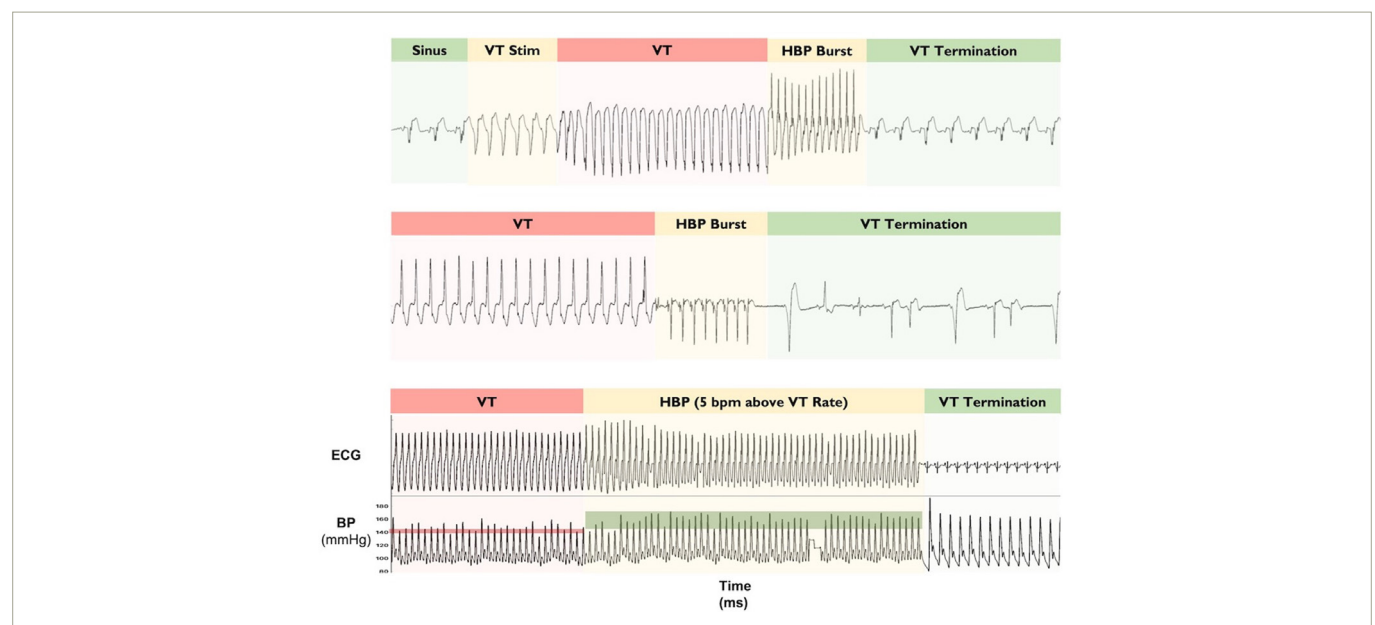
Results: Ten patients with clinical VT were recruited. Ninety per cent were male with a mean age 71, and mean LVEF 28%. Half had ischaemic cardiomyopathy, and the mean clinical VT rate was 142 ± 21 bpm.

His bundle pacing during clinical VT increased systolic blood pressure by +14.2% (CI: 7.8–20.6; $p=0.0023$). Once entrained, the interval from stimulus to QRS onset was 45 ± 18 ms, in keeping with ventricular activation via the His-Purkinje system.

In 6 of 10 patients, VT terminated with His bundle pacing without accelerating VT or developing VF.

Conclusions: His bundle pacing during clinical VT can improve haemodynamic function and even terminate VT episodes. Further study is required to (1) confirm these findings, (2) to optimize the therapeutic pacing approach and (3) to compare efficacy against ATP delivered from the RV. □

Figure 1





Moderated Posters 2

57/Physiologist-led implantable loop recorder wound review: A single-centre audit assessing patient satisfaction and complication rates

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr57

Authors: CR Redmond (Presenting Author) – St Thomas' Hospital, London, UK; PI Ihionvien – St Thomas' Hospital, London, UK

Introduction: Implantable loop recorder (ILR) implantation has become a mainstay for management of infrequent symptoms suspected to be of arrhythmic origin. Since their first documented use in 1990, these devices have seen multiple iterations and are now self-contained injectable systems that can be implanted by non-medical staff with additional training. Cardiac physiologist (CP)-led implant services have become widely adopted across the UK, and demonstrated a proven benefit in reducing waiting times and improving patient satisfaction. For CPs to be able to undertake these procedures that would otherwise be out of their usual scope of practice, they must undertake additional specialised training, including becoming competent in wound closure. Whilst there have been studies on methods of wound closure with larger wounds, there remains no distinct wound closure guidelines for smaller wounds, such as those made during ILR insertion/removal. This results in different centres utilizing different methods of wound closure, resulting in variability in patient satisfaction, complication rates, procedure techniques, cost and staff training requirements. This single tertiary -centre prospective audit aimed to establish complication rates and patient satisfaction, in 21 patients, after CP-led ILR insertion/removal with wound closure using Steri-Strips™.

Methods: Patients undergoing ILR implant or explant in the CP-led service were asked to send a photograph of their wound to a secure email inbox, 4 weeks post-procedure. The photographs were reviewed

by CPs and assessed using a standardized form. Patients were then telephoned and given a standardized questionnaire on their overall experience. Answers were recorded and saved onto a secure password protected folder.

Results: Overall, patients had a positive experience with regards to wound healing after implant or explant. Patients reported minimal bleeding and most dressings being removed between 4–10 days. One patient reported dissatisfaction and suffered a complication requiring wound review. This has established that Steri-Strips™ are a safe method of wound closure, and provide patients with a satisfactory and positive experience.

Conclusions and implications: This audit has demonstrated that Steri-Strips™ are a satisfactory method of wound closure for patients undergoing ILR implant or explant in a CP-led clinic. Minimal complications were observed and the overall experience of patients undergoing ILR implant or explant was positive. At present, there is minimal data on wound closure for ILR procedures, especially with reference to CP-led clinics. In an effort to standardize care, future research projects directly comparing methods of wound closure in CP-led ILR implant and explant clinics should be conducted to compare safety and patient satisfaction of all available methods. Impacts on cost benefit, time per procedure and operator experience per method of wound closure should be studied in addition, to provide a comprehensive overview of the service and its users as a whole. □

Posters 1

58/An unusual presentation of pacemaker RV lead perforation, or is it?

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr58

Authors: [KL Murray](#) (Presenting Author) – East Kent Hospitals University Foundation Trust, East Kent, UK

A 76-year-old male attended clinic for routine annual follow up of a dual chamber pacemaker which was implanted just over 2 years prior for bifascicular block and multiple episodes of syncope. Presenting rhythm over the device lifetime had typically been sinus rhythm with <5% VP. The following lead parameters were measured:

- RV lead impedance – 699 ohms (bipolar), 523 ohms (unipolar);
- R wave amplitude – 6.1 Mv;
- RV lead threshold – 7 V @ 1.5 ms (bipolar), >7.5 V @ 1.5m s (unipolar) (previously 1.4 V @ 0.4 ms bipolar);
- implant parameters;
- RV lead impedance – 1,063 ohms (bipolar);
- R wave amplitude – 17.9 Mv; and
- RV lead threshold – 0.5 V @ 0.4 ms.

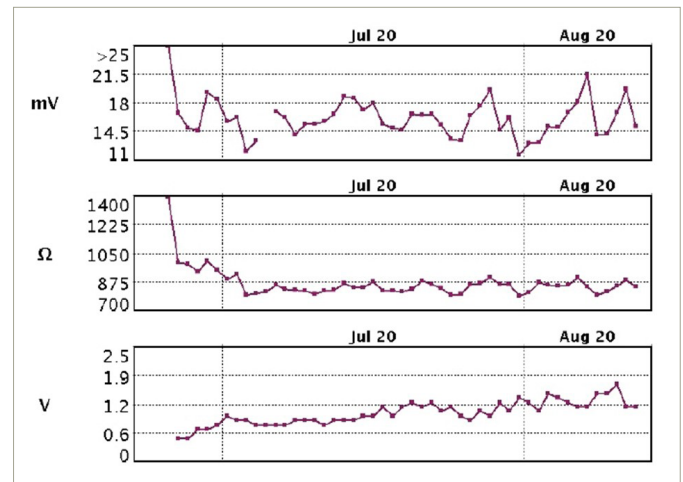
The patient was asymptomatic, with a normal echo. Around 1 month later, he presented to clinic with stabbing chest pains following a hip replacement that he was taking prophylactic blood thinners for. Testing showed that the RV lead was not capturing at max output of 7.5 V @ 2 ms and the R wave had dropped to 1.8 Mv. Repeat echo remained normal. Another month later, the patient presented to A&E with chest pains and a sensation that the pacemaker was delivering shocks. The CT report from the previous week was chased and revealed that the tip of the RV lead was ‘beyond the confines of the myocardium and abutting the pericardium... No evidence of pericardial effusion’.

The patient was admitted to hospital to wait for transfer to a tertiary centre for system extraction. A further pacing check was performed, which found the R wave had deteriorated to the point where the device was no longer able to sense.

We have also seen another patient the same week who again presented 2 years post implant, but with pericardial effusion which required draining. The post-procedure CT showed an RV lead tip perforation and the device was checked. There was no pacing at max output and no sensing. This patient also exhibited a significant impedance drop from 1,600 ohms to 650 ohms, with a bipolar threshold at 6 weeks of 2V @ 1 ms.

It is not clear how many cases there are of perforation in asymptomatic patients or those who do not present with pericardial effusion due to low

Figure 1



suspicion or assumption of chronic lead deterioration. However, Sidhu, Ranjani and Rinaldi have presented a case where an asymptomatic patient underwent new RV lead implant due to increased threshold of 1.75 V @ 1 ms.¹ The patient was investigated for perforation of the new lead due to new onset of symptoms. It was assumed that the new RV lead had perforated the RV, however it was discovered on CT that the chronic 14-year-old lead was the culprit, which lead to the patient needing a further procedure to extract the lead.

RV lead perforation is mostly expected to be an acute complication leading to pericardial effusion and cardiac tamponade, however there is evidence that some patients are presenting with chronic perforation or microperforation who may exhibit atypical symptoms and lead measurements. If there is a rise in bipolar RV threshold post implant (especially if accompanied by any significant drop in pacing impedance), then unipolar threshold should be tested and documented. Patients with a higher unipolar threshold can then be highlighted to their consultant cardiologist and investigated for suspected lead perforation in the early stages, and potentially avoid a late presentation with patient compromise. □

1. Sidhu BS, Rajani R and Rinaldi CA. Chronic ventricular lead perforation: Expect the unexpected. *Clin Case Rep*. 2019;7:465–8.

Posters 1

59/Inconspicuous right ventricular lead displacement: The importance of the ECG in device clinic

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr59

Authors: [CM Mehegan](#) (Presenting Author) – West Suffolk NHS Foundation Trust, Bury St Edmunds, UK

Case background: An 82-year-old male was referred for outpatient device implantation for symptomatic junctional bradycardia. A dual chamber Boston Scientific generator was implanted with active fixation leads secured in the right atrial appendage and right ventricular septum. The procedure was without complication and the device was programmed DDD 50–130 bpm.

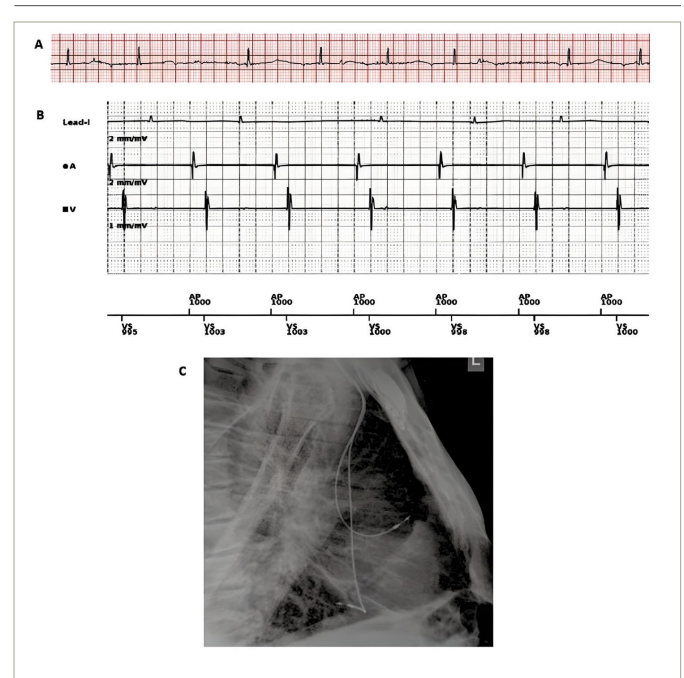
Implant parameters: R wave 9.8 Mv and no P wave at 30 ppm. Both thresholds 0.5 V at 0.4 ms. Two hours later, the patient was recovering well post-procedure, but reported some transient postural dizziness. Blood pressure was stable at 139/68 mmHg (supine) and 130/60 mmHg (sitting); however, a telemetry strip showed a slow, irregular rhythm with clear atrio-ventricular dissociation (Figure 1A). A follow-up device check was performed to review the rhythm and device function. Figure 1B shows the presenting EGM and a lead I telemetry strip.

Electrogram interpretation: On initial review of our presenting AEGM (Figure 1B) we can see an AP marker with local atrial capture. On the VEGM, we can see a sharp signal around 160 ms post-AP, in line with our versus marker. It would not be unreasonable, given the implant indication, to assume correct device function based on this atrial paced rhythm with consistent atrio-ventricular conduction. However, on closer inspection of the VEGM, we can see irregular, low amplitude signals which do not correlate with our marker channel. The signals bear no relation to our VS events, and are therefore unlikely to be associated with T-wave oversensing. Out of context, and in the absence of symptoms or ECG abnormalities, these additional signals may be ignored.

In this case, we have a telemetry strip (Figure 1A) that shows regular bipolar pacing spikes and an irregular narrow complex ventricular rhythm, warranting further investigation given the patient's symptoms. Looking at the bigger picture (Figure 1B), we have conflicting information from our intra-cardiac EGM and surface ECG.

In this case, we present paced P-wave oversensing on the VEGM, in the context of latent atrial capture. Each VS signal occurs around 160 ms post-AP event, suggesting the two events are related. Our surface QRS complexes are not sensed on our VEGM, therefore our VS signals must be atrial in origin. Looking back, the patient initially presented with a junctional bradycardia; therefore, we were not able to comment on AV conduction time. On review of Figure 1B, it is clear this patient has variable AV conduction; reflected in the irregularity of the ventricular rhythm on the surface ECG. Given the evidence of P-wave oversensing

Figure 1



and the likelihood of acute lead displacement post-implant, a chest X-ray was performed to confirm the aetiology of the issue (Figure 1C).

Case summary: Figure 1C shows the right ventricular lead has displaced from the ventricular septum and is freely moving within the right ventricle, close to the tricuspid valve. The proximity of the displaced ventricular lead to the atria explains the paced P-wave oversensing. This case highlights the importance of a live ECG trace during all routine device checks. Although EGM signals show us what a lead is sensing, this is only relevant if we know where that lead is positioned. Our pacing programmer provides us with a unique opportunity to simultaneously review surface ECG and intra-cardiac EGMs, allowing for a comprehensive review of rate, rhythm and lead position. □



Posters 1

60/Developing and implementing a digital care pathway for patients with AF using remote monitoring

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr60

Authors: K Saleh (Presenting Author) – Harefield Hospital, London, UK; J Syan – Chelsea and Westminster NHS Trust, London, UK; M Wright – Chelsea and Westminster NHS Trust, London, UK; S Pearce – Chelsea and Westminster NHS Trust, London, UK; J Barrett – Chelsea and Westminster NHS Trust, London, UK; J Bird – Chelsea and Westminster NHS Trust, London, UK; S Khan – Chelsea and Westminster NHS Trust, London, UK

Introduction: Technological innovations, catalyzed by the COVID-19 pandemic, have opened new avenues for remote monitoring, screening and diagnostics in cardiovascular care. Atrial fibrillation (AF) has a huge healthcare burden within our health service and is a major contributor to presentations to health services, hospitalizations, morbidity and mortality. We identified an opportunity to digitize and enhance our pre-existing AF care pathways through the same day emergency care unit (SDEC) and through implementation of an early supported discharge pathway, using an approach that leverages digital remote monitoring technologies. In this abstract, we share our experience and the impact of our approach on clinical outcomes to date.

Methods: We conducted an initial audit of patients presenting to ED or admitted with newly diagnosed or poorly controlled AF, spanning a 6-month period from March to September 2022. We found that around 10% of patients reattended ED within 30 days of discharge with an arrhythmia-related presentation, of whom over a third required admission, representing an average of 5.5 bed days. With this in mind, we devised a digital model of care to enable patients to be remotely monitored for up to 2 weeks in their home environment while recovering from an acute hospitalization, aiming to reduce unplanned ED reattendances and readmissions, and to promote early supported discharge in suitable patients. Our approach integrated two digital elements: a smartphone-based heart rhythm and symptom monitoring app (FibriCheck) and a digital interface, integrated with the patient



electronic health record, to which real-time device data can be uploaded and reviewed (Care Information Exchange/Patient Knows Best). A central sector-level remote monitoring hub, staffed by trained specialist nurses, managed the virtual AF ward environment and conducted telephone triage assessments, escalating to the cardiology team where needed. A traffic light system was employed, guided by NICE and ESC guidance, to determine parameters for care escalation, such as expedited review in SDEC or recommendations to attend ED for assessment.

Results: The pathway went live in November 2022 and we have enrolled 39 patients to date, 95% of whom engaged with remote monitoring. Six patients (15%) were appropriately advised to attend ED and a further 5 patients (13%) were instructed to attend for an expedited review in SDEC in view of abnormal parameters and/or symptoms following telephone assessment. Over a 3-month period, only 2 patients were hospitalized for an arrhythmia-related presentation (1 patient was non-compliant with remote monitoring, 1 patient ran out of bisoprolol). AF patients with early-supported discharge via the pathway had an average 4-day shorter length of stay. We have received positive patient feedback overall.

Conclusion: We share our experience of a novel digital model of care for remote monitoring of AF following acute hospitalization. Our findings suggest improved care delivery, reduction in rates of rehospitalization, shorter inpatient stay and improved patient experience. A similar care model could be replicated across other NHS trusts. □





Figure 1: Patient flyers used as part of the patient onboarding process for the Care Information Exchange platform and FibrCheck app



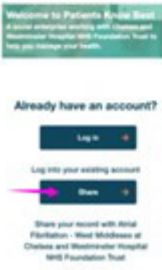
The Care Information Exchange (CIE) is the personal health record for patients and service users in North West London.

CIE, powered by Patients Know Best, provides secure online access to your health information all in one place. It allows you and your health care team to manage your heart condition remotely.


To set you up with your Atrial Fibrillation team and get all your medical advice and support in your CIE record, please follow the steps below.



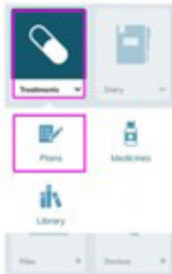
1 Scan the QR code in the upper right corner with your device's camera and click **Share**.




2 If you already have an account, click **Log in**, or you can use the **NHS login** to create an account.



3 Once you are in your record, go to **Treatments**, then **Plans**.




4 Click **Add plan** and choose the **Atrial Fibrillation Care Plan** from your team.




FIBRICHECK


YOUR HEART'S HEALTH AT YOUR FINGERTIPS

FibriCheck is a medically certified app capable of measuring your heart rhythm and detecting possible arrhythmias with the use of your smartphone or smartwatch. Your physician prescribed the app to determine the need for further follow-up, possibly related to an upcoming (tele)consult.




1 **DOWNLOAD FIBRICHECK** 


Download the FibrCheck app on your smartphone (via the Apple App Store or the Google Play Store).

2 **CREATE YOUR ACCOUNT** 


Enter your name, your sex, your birthday and your country. Next, fill in your email address. If you gave your physician your email address, please use that one. After that, choose a password.

3 **ACTIVATE YOUR INVITATION CODE** 


Tap 'Start measurement', choose 'I have a QR code' and scan the QR code in the app with your camera or choose 'I have a regular code'. You can find both codes at the top right of this flyer.

4 **CONNECT YOUR PATIENT KNOWS BEST ACCOUNT** 

Go to 'Settings' and tap on 'Connected apps'. Then select 'Patient Knows Best'. Tick the box to share your FibrCheck measurement data with Patient Knows Best and tap 'Connect'. Log in with your Patient Knows Best email address and password. Tap on 'Back to app' and then on 'Open in FibrCheck' to start measuring.

5 **PERFORM MEASUREMENTS** 

Tap 'Start measurement' again. Place your finger gently on your smartphone camera. After a 60-second measurement your data is sent to your caregiver.

6 **CHECK YOUR RESULTS** 

After each measurement you will receive a high level report of your results. All of your data is available for your physician. He or she will contact you in case further follow-up is needed.

EUROPEAN JOURNAL OF ARRHYTHMIA & ELECTROPHYSIOLOGY

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Posters 1

61/Short QT interval, a diagnostic dilemma in cardiac arrest

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr61

Authors: M Kuehl – University Hospital of Coventry and Warwickshire, Coventry, UK; S Yusuf – University Hospital of Coventry and Warwickshire, Coventry, UK; T Mahdy (Presenting Author) – University Hospital of Coventry and Warwickshire, Coventry, UK

Introduction: Cardiac arrest in relatively young patients is a difficult presentation to manage, with multiple potential causes. Establishing an accurate diagnosis is crucial and has implications on first-degree relatives. Here we present the case of a 56-year-old female with a first presentation of cardiac arrest, highlighting some of the diagnostic and treatment challenges encountered.

Case presentation: A 56-year-old lady with a past medical history of hypertension, paroxysmal atrial fibrillation, high body mass index (BMI), a right hemicolectomy for bowel cancer with ongoing chemotherapy and no significant family history, presented to the hospital feeling generally unwell on the advice of the oncology team. She had recently restarted her chemotherapy (capecitabine) after a viral illness and became unwell shortly after. Whilst undergoing initial assessment, patient suffered a cardiac arrest with ventricular fibrillation in the emergency department. She was successfully resuscitated following direct cardioversion. Initial investigations were unremarkable apart from raised cardiac troponin of 600 ng/L. A 12-lead ECG demonstrated atrial fibrillation with a corrected QT interval of 343 ms. Following the neurological recovery, invasive coronary angiography showed normal coronary arteries, and a cardiac MRI (CMRI) was requested to exclude myocardial infarction with nonobstructive coronary artery disease (MINOCA) and demonstrated a structurally normal heart, with evidence of non-specific diffuse myocardial fibrosis. Implantable cardioverter defibrillator (ICD) was inserted for secondary prevention inserted and she was referred for genetic testing for a likely diagnosis of short QT syndrome.

Discussion: This case is a diagnostic dilemma due to two possible causes of her cardiac arrest, both with significant consequences. The possible coronary vasospasm caused by capecitabine will have implications on her cancer treatment, along with short QT syndrome, which requires family screening. Coronary spasm secondary to capecitabine is a well-known side effect. Usually presenting with chest pain, however cardiac arrest remains a possibility. Here, the diagnosis will lead to capecitabine discontinuation with an impact on bowel cancer survival. However, the absence of CMRI changes made this an unlikely explanation. Short QT syndrome (SQTS) is a rare, hereditary channelopathy. It is associated with an increased risk to develop atrial and ventricular tachyarrhythmias in the absence of structural heart disease. Gain-of-function mutations of potassium and loss of function mutations of calcium channels result in an abbreviated repolarization

Table 1: The Short QT Syndrome Diagnostic Scoring Scheme

Findings	Points
QTc, ms	
<370	1
<350	2
<330	3
J point-T peak interval <120 ms	1
Clinical history	
History of sudden cardiac arrest	2
Documented polymorphic VT or VF	2
Unexplained syncope	1
Atrial fibrillation	1
Family history	
First- or second-degree relative with high-probability SQTS	2
First- or second-degree relative with autopsy-negative sudden cardiac death	1
Sudden infant death syndrome	1
Genotype	
Genotype positive	2
Mutation of undetermined significance in a culprit gene	1
Total	
Probability of short QT syndrome	
High	4 points
Intermediate	3 points
Low	2 points

phase during action potential and shortening of the QT interval. The clinical diagnosis is based on the scheme summarised in Table 1. ICD implantation is recommended for all survivors of sudden cardiac arrest or patients with documented spontaneous sustained VT with or without syncope. Quinidine and sotalol may be considered for asymptomatic patients with SQTS, if family history of sudden cardiac death is present. Screening of first-degree relatives should always be considered after formal diagnosis.

Conclusion: Establishing the underlying cause of cardiac arrest should be pursued vigorously, due its implications on management. SQTS is rare, but important cause of cardiac arrest and should not be neglected. Survivors of cardiac arrest secondary to SQTS should have an ICD implant and be referred for family screening. □



Posters 1

62/Atrial fibrillation screening and mild cognitive impairment in patients attending community podiatry. A scoping review and cross-sectional study

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr62

Authors: *E Kirwan (Presenting Author) – University of Galway, Galway, Ireland; C McIntosh – University of Galway, Galway, Ireland; C MacGilchrist – University of Galway, Galway, Ireland; E Carty – Health Service Executive, Galway, Ireland*

Introduction: Atrial fibrillation (AF) is the most common arrhythmia globally in adults and its prevalence increases with age. The incidence of mild cognitive impairment (MIC) also increases with age. Both MCI and AF share important risk factors.

Aims: This study aimed to examine the relationship between MCI and AF through a phased approach. Phase one was a scoping review, and phase two of the ALERT project was a cross-sectional study.

Research methods and sample: This scoping review was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). The cross-sectional study opportunistically screened 214 participants for MCI and AF in a podiatric community setting in the West of Ireland.

Key findings: The scoping review included 38 studies. Across the included articles, the mean prevalence of MCI in patients with AF was 37.84%. The main proposed pathologic mechanisms linking MCI and

AF from the articles were white matter lesions, cardiovascular risk factors, silent cerebral infarction and cerebral hypoperfusion. The most common tools used in these studies to identify MCI were a battery of cognitive tests and the MoCA test. Phase two opportunistically screened 214 patients for AF and MCI. The prevalence of AF in this cohort was 15.4%. In total, 50 (23.4%) participants had MoCA scores less than 26 indicating MCI and 7 (3.2%) participants had MoCA scores less than 17 indicating moderate cognitive impairment. A statistical significance was found; those with arrhythmia had lower MoCA scores indicative of cognitive impairment ($P=0.025$).

Conclusion: This project highlighted the relationship between MCI and AF. This research shows the critical role that podiatrists can play in the early detection of these conditions. Future studies could further evaluate the role of podiatrists in opportunistic screening for arrhythmia and particularly examine the prevalence of AF and MCI in a more racially diverse population. □



Posters 1

63/Improving education and management of cardiovascular disease (CVD) through a primary care fellowship programme: A South London experience

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr63

Authors: S Mizen – Health Innovation Network, London, UK; A Caruso – Health Innovation Network, London, UK; R Jogiya (Presenting Author) – Kingston Hospital, Kingston, UK

Introduction: The NHS Long Term Plan identifies CVD as the single biggest area where lives can be saved. Primary care provides a crucial role in the management of patients at risk of CVD. Offering a programme can help empower and improve confidence and management of high-risk conditions among clinicians.

Methods: We held series of monthly clinical webinars over seven months for healthcare professionals in south London. Topics included: atrial fibrillation (AF), lipid management, AF case studies. Alongside this, the fellows undertook an improvement project. This concluded with a showcase and learning event where case studies were shared, learnings discussed, future CVD work considered, and fellows encouraged to continue their work.

Results: In total, there were 19 educational sessions over 17 hours of lectures. One hundred and four fellows signed up to the programme - 85 (81%) were upskilled in different clinical aspects of CVD prevention; 54 fellows submitted final reports on their improvement projects. There were:

- 4 projects in atrial fibrillation, impacting 8 GP surgeries;
- 19 projects in hypertension, impacting 21 GP surgeries;
- 14 projects in lipids, impacting 22 GP surgeries;
- 3 projects in familial hypercholesterolaemia, impacting 7 GP surgeries; and

- A survey conducted at the end of the fellowship with feedback from 47 fellows. This revealed that as a result of the fellowship:
 - 97% felt they were supporting colleagues more with CVD care;
 - 97% felt more confident in delivering CVD care;
 - 74% felt their PCN/practice has improved the way it manage patients at risk of CVD; and
 - 95% felt their patients at risk of CVD have benefited.

Conclusions: Overall, primary care practitioners considered the fellowship program as relevant and beneficial to patient care. The high-risk conditions for cardiovascular disease, atrial fibrillation, high cholesterol and hypertension can be asymptomatic. They are often underdiagnosed and undertreated. Earlier recognition and management may improve long term outcomes. Following the educational sessions, a number of QI projects were undertaken in these fields, addressing areas of CVD prevention and management locally. Small improvements may have long term impact. Primary health care is a complex environment that may benefit from structured systems of education to aid the adoption of best practice. With so many competing demands there remain gaps between CVD management guidelines and practice in primary care. Although substantial challenges remain in implementing change, this programme was seen as a beneficial and helpful method of facilitating long term improvement of the management of patients with or at risk of CVD. □

Posters 1

64/Evaluating the effectiveness of TriageHF remote monitoring of heart failure patients with cardiac resynchronization therapy devices in reducing heart failure decompensation and hospitalization

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr64

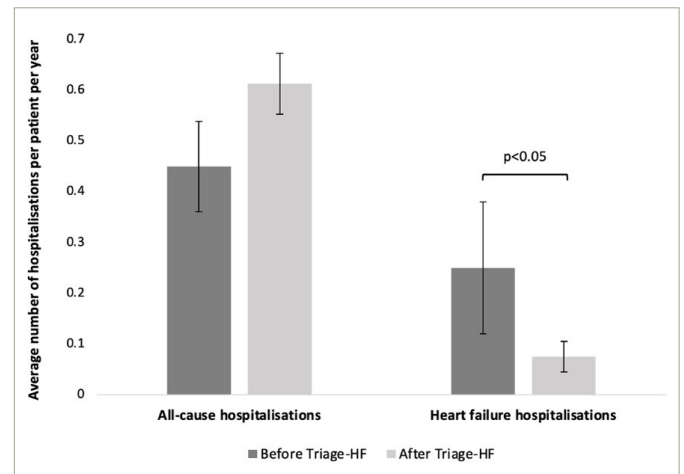
Authors: [LF Anderson](#) (Presenting Author) – King's College Hospital, London, UK; [P Khan](#) – King's College Hospital, London, UK; [B Sidhu](#) – Croydon Health Services NHS Trust, Croydon, UK

Background: TriageHF (Medtronic) is a remote monitoring algorithm that stratifies a patient's risk of a heart failure (HF) event within the next 30 days as high, medium or low, based on integrated cardiac resynchronization therapy (CRT) device diagnostic data. TriageHF remote monitoring became part of standard care at King's College Hospital in 2021. Physiologists are automatically alerted of high-risk patients, which prompts urgent telephone assessment to identify those with genuine worsening HF. Timely review and treatment of high-risk patients aims to prevent HF decompensation and hospitalization.

Methods: This single-centre retrospective service evaluation investigated whether TriageHF accurately identified those with worsening HF and reduced HF hospitalizations at our trust. Eighty patients with Medtronic CRT devices and TriageHF remote monitoring enabled were identified. Data regarding patient demographics (including HF aetiology, ejection fraction and relevant medications), number of all-cause and HF hospitalizations, and number and classification of TriageHF transmissions were collected from electronic patient records. Data from the year before TriageHF initiation (2020–2021) were compared to that of the year following TriageHF initiation (2021–2022).

Results: The number of HF hospitalizations was significantly lower in the year following TriageHF initiation compared with the year before (0.25 versus 0.075 mean events per patient year, $p < 0.05$). There was no significant difference in the number of all-cause hospitalizations. Between 2021 and 2022, a total of 339 TriageHF transmissions were received, of which 43 (12.68%) were classified as high-risk, 98 (33.33%) as medium-risk and 153 (54.04%) as low-risk. The CRT device physiological parameters that most commonly contributed to high-risk TriageHF transmissions were OptiVol (72.09%) and patient activity (65.17%). Telephone assessment of high-risk transmissions confirmed 18 (41.86%) as positive for worsening HF. Clinical intervention for positive

Figure 1



high-risk patients most commonly included optimization of current cardiac medication (72.22%). Only 1 (5.56%) positive high-risk transmission was associated with HF hospitalization within 30 days of the alert despite clinical intervention.

Conclusions: TriageHF permitted timely review and treatment of patients with worsening HF and successfully reduced the incidence of HF hospitalization. The combination of integrated device diagnostic data and protocolised telephone assessment of patients offered an efficient alternative to in-person clinical assessment, providing convenience to patients and burden relief for the HF team. Overall, this study demonstrates the importance of robust remote monitoring pathways, like TriageHF, for optimising the care of patients with HF. □



Posters 1

65/What govern immediate or delayed cardioversion of persistent atrial fibrillation by DC shock?

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr65

Authors: Amar Alhamdi (Presenting Author) – Alhamdi Heart Clinic, Sulaimanya, Iraq

Background: DC-cardioversion of atrial fibrillation may be immediate or delayed after shock delivery.

Objective: To characterize each phenomenon, the immediate or delayed reversion of atrial fibrillation.

Patients and methods: Patients with persistent atrial fibrillation who reverted to sinus rhythm with DC-cardioversion were included in this case series study. One group showed immediate reversion and the other showed delayed reversion after shock delivery. The duration of the atrial fibrillation, the ventricular rate range before reversion, the preceding drug therapy, patient weight and left atrial size were studied in these two groups of patients to see what factors affect reversion pattern.

Results: From a total of 86 patients with persistent atrial fibrillation exposed to DC-cardioversion, 77 (89%) patients reverted in to sinus rhythm were included. Fifty patients reverted immediately and 27 patients reverted lately. The average ventricular rate was faster in the immediate group of 165 versus 125 in the delayed group. The LA size is slightly larger in the delayed group. Preceding drug effect was not significant in both groups. The duration of the arrhythmia is shorter in the immediate group.

Conclusion: The delayed or immediate reversion of atrial fibrillation in to sinus rhythm with DC-shock is governed by the VR preceding the reversion, the duration of the arrhythmia and the LA size. □



Posters 1

66/Transforming our post-atrial fibrillation ablation follow up patient pathway using FibrCheck: A smartphone digital app used for remote monitoring

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr66

Authors: S Toora (Presenting Author) – Essex Cardiothoracic centre, Chelmsford, UK; NT Srinivasan – Essex Cardiothoracic Centre, Basildon, UK; A Sharma – Essex Cardiothoracic Centre, Basildon, UK

Background: Post-atrial fibrillation (AF) ablation clinics are typically in person, whereby 12-lead electrograms (ECG) and/or Holter monitors can detect recurrence. During the COVID-19 pandemic, at our site, nurse-led clinics were telephonic, and timely access to these investigations became difficult.

Objective: To determine if the validated smartphone application FibrCheck, which uses photoplethysmography to detect AF, can remove the need for in-person monitors, thereby reducing costs.

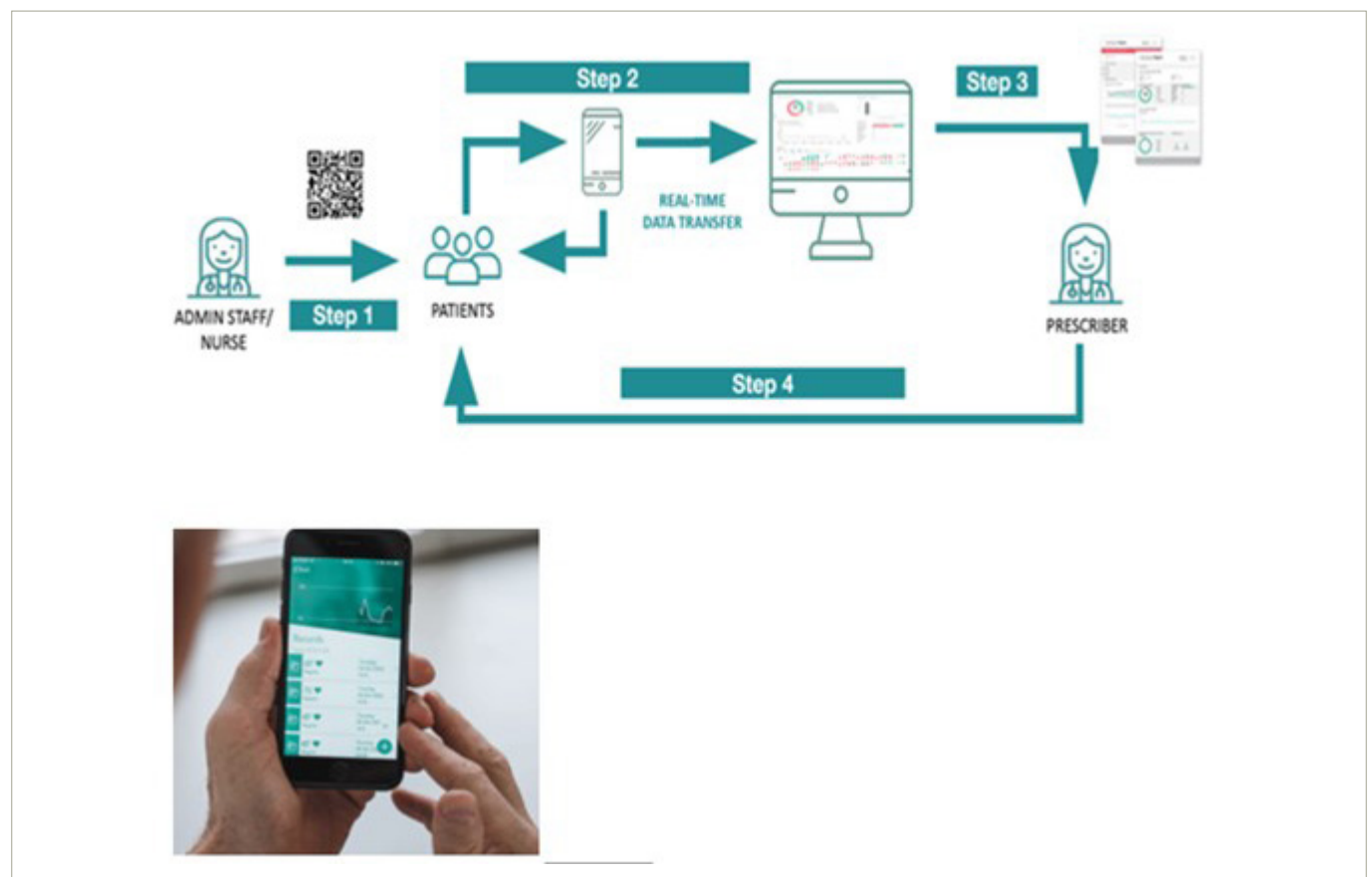
Method: Adult patients post-AF ablation from September 2021 to January 2023 from Essex Cardiothoracic Centre, UK were consented and given two different 7-day subscriptions to FibrCheck leading up to their 3 and 12-month appointments respectively. They were asked to measure their heart rate and rhythm up to 3 times a day during that period. A detailed summary was sent from FibrCheck to the arrhythmia nurse, prior to patient's appointment.

Results: One hundred and forty-seven patients participated in this study. Seventy-eight per cent were male. The average age was 62 years. An average of 27 measurements were taken by each patient during

the subscription period. Compliance was uniform across all ages. Thirty-nine patients (26.5%) detected AF recurrence during their subscription period within 12 months. Of these, 28 patients were symptomatic, with the most reported symptom being dyspnea. We estimate that due to the use of FibrCheck, 147 ECGs and 55 seven-day Holters were avoided, equaling net savings of £19,040 and 73.5 outpatient clinic hours.

Conclusion: Using FibrCheck, 12-lead ECGs and Holters were avoided, reducing the burden on primary care, and releasing Holter monitors to patients with higher acuity. This also equated to significant cost and time savings, allowing for increased efficiency of the service, and making a positive impact on the carbon footprint. FibrCheck allowed safe at-home remote monitoring of symptoms with timely diagnosis, detection, and management of AF recurrence for patients in our post-AF ablation clinics. This is an easily replicated and cost-efficient service. Further expansion of FibrCheck is in progress, for follow up of patients post-synchronised cardioversion for AF. □

Figure 1



Posters 1

67/Improving medical therapy for patients with heart failure with reduced ejection fraction and implantable cardiac devices: A proactive multidisciplinary clinical pathway

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr67

Authors: *HJ Williams* (Presenting Author) – Bristol Heart Institute, Bristol, UK; *AK Nightingale* – Bristol Heart Institute, Bristol, UK; *I Diab* – Bristol Heart Institute, Bristol, UK

Introduction: Medical therapy for heart failure with reduced ejection fraction (HFrEF) improves quality of life, reduces heart failure hospitalization and mortality, and reduces the risk of ventricular arrhythmias. International guidelines recommend four key drug classes for all patients with HFrEF. However, many patients do not receive them. Implementing clinical pathways to increase access to HFrEF medical therapy is therefore a high priority.

In the UK, most patients with implantable cardiac devices are followed-up in a device clinic led by cardiac physiologists. Many of these patients also have HFrEF but do not have ongoing review in a heart failure clinic if they are clinically stable. As a result, they may not be prescribed current guideline-directed medical therapy.

A new clinical pathway was therefore created to identify patients with HFrEF under follow-up in the device clinic, and then refer them to a combined device and heart failure clinic to optimise their medical therapy.

Methods: The pathway was implemented in a single UK tertiary cardiac centre. The cardiac physiology team were trained to screen patients attending device follow-up clinics for HFrEF, through review of medical records and cardiac imaging. All patients with HFrEF, who were not under the active care of a heart failure team, were referred to a combined device and heart failure clinic.

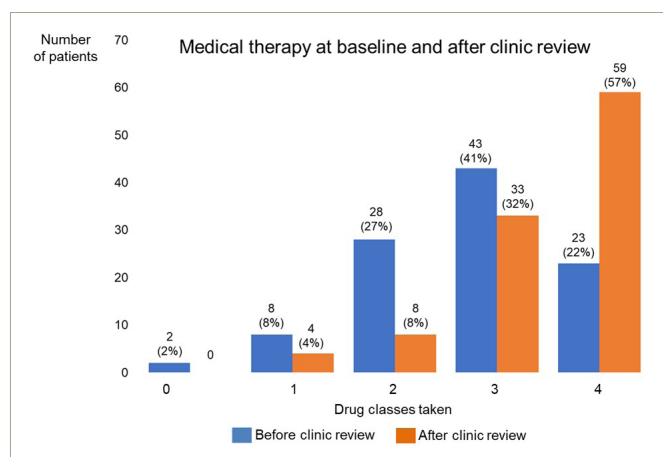
Results: One hundred and forty-seven patients were referred to the new combined clinic from August 2022 over a 7-month period. One hundred and forty-one out of 147 (96%) patients attended; 104/141 (74%) had HFrEF and 37/141 (26%) had either HfmrEF or HfpEF.

Of the 104 patients with HFrEF, mean age was 71 years (range 29–94) and 76% were male. At baseline, 8/104 (8%) were in NYHA class I, 56/104 (54%) class II, 40/104 (38%) class III and 0/104 in class IV.

Forty-four out of 104 (42%) had a CRT-D, 26/104 (25%) had a CRT-P, 17/104 (17%) had a single or dual chamber ICD, 9/104 (9%) had a single or dual chamber pacemaker and 8/104 (8%) who were referred from other sources did not have a device.

At baseline, only 23/104 (22%) patients with HFrEF were prescribed all

Figure 1: Medical heart failure therapy drug classes at baseline and following combined device and heart failure clinic review



4 drug classes. Following combined clinic review, after an average of 1.8 appointments, 59/104 (57%) patients were prescribed these four drug classes (see Figure 1). In addition, drug doses prescribed at baseline were up-titrated in 39/104 (38%).

Conclusion: Screening all patients attending the cardiac physiologist-led device follow-up clinic was an effective way to identify those with HFrEF who were not under the care of a heart failure team. In this population, medical therapy at baseline was not optimal. Following combined device and heart failure clinic review, the number of patients taking all 4 guideline-directed drugs for HFrEF increased markedly from 22% to 57%. Joint working between heart failure services and implantable cardiac device services can therefore both identify patients with HFrEF who are under-treated and then significantly improve their medical therapy. □

Posters 1

68/The impact of a pharmacist: Advanced clinical practitioner involvement on a general heart rhythm outpatient cardiology clinic within a busy tertiary cardiac centre

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr68

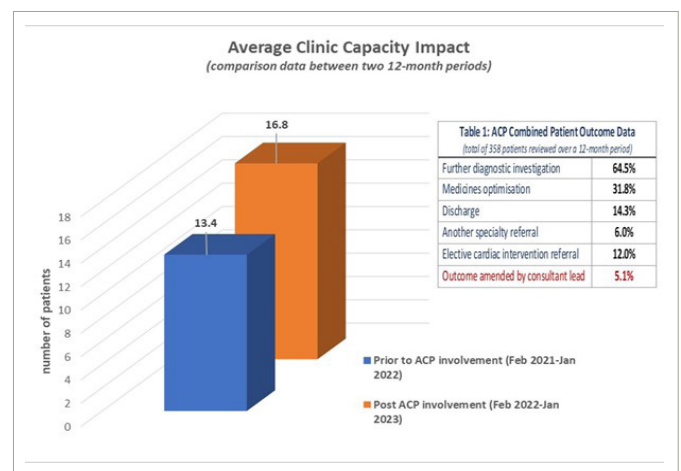
Authors: *AD Dimitrov* (Presenting Author) – Royal Brompton and Harefield Hospital (part of Guys and St. Thomas NHS Foundation Trust), London, UK; *SH Haldar* – Royal Brompton and Harefield Hospital (part of Guys and St. Thomas NHS Foundation Trust), London, UK

Introduction: Advanced clinical practice (ACP) is an established structured university programme available to registered non-medical clinicians. ACP training prepares those healthcare professionals to safely manage clinical care within both in- and outpatient setting, and incorporates complex clinical decisions and a high degree of autonomy. Aim: To assess the service impact, safety and efficiency of a clinical cardiology pharmacist with additional ACP training, providing a sustainable, holistic and independent clinical care to non-predefined cohort of heart rhythm patients within a consultant-led cardiology clinic environment.

Methods: A pharmacist-prescriber in their last year of an ACP training programme within a tertiary cardiac centre autonomously reviewed randomly selected patients, face-to-face or virtually, in a busy outpatient heart rhythm clinic, once weekly over a 12-month period. Clinical examination, diagnostic skills and IRMER training were completed prior to commencing. Data was collected from each clinic capturing number of patients reviewed, time spent per patient and consultation outcomes. Clinical decisions made for every patient were timely discussed with the consultant lead to assess the safety of this service concept.

Results: A total of 217 patients were reviewed – 61 (28.1%) were newly referred, 135 (62.2%) were routine follow-up patients and 21 (9.7%) were booked for their first post-intervention review. Mean number of patients reviewed by ACP per clinic was 5.93 (\pm 1.46) compared with 7.03 (\pm 1.26) by a consultant. On average 17.5 (\pm 2.43) minutes were spent per patient. Outcome data revealed 140 (64.5%) had further diagnostic tests organised, 69 (31.8%) had their medications optimised, 31 (14.3%) were discharged and 13 (5.99%) patients were referred to a different specialist. Patients directly referred for an elective outpatient heart rhythm intervention were 26 (11.98%), of which 18 (8.29%) for an ablation procedure, 7 (3.23%) for direct current cardioversion and 1 (0.46%) for a device implantation. No patients were admitted to hospital directly from clinic. Eleven patients (5.06%) had their plan changed following

Figure 1: Average clinic capacity impact



consultant oversight safety discussion. Over 12 months, ACP total patient discharge rate was 14.3%, compared with 14.7% by consultant. Clinic capacity increased by 28% ($p < 0.01$) from 13.4 to 16.8 patients per clinic slot on average.

Conclusion: Our study demonstrates that a clinical pharmacist prescriber with an additional accredited ACP training in cardiology can apply their skillsets and expertise to make safe and appropriate autonomous clinical decisions and provide efficient and complete patient care extending beyond medicines optimization. An ACP pharmacist involvement in a consultant-led heart rhythm clinic has the potential of improving the use of NHS staff resource and increasing outpatient clinic efficiency and patient access to specialist services without compromising patient safety. □



Posters 1

69/Atrial fibrillation and COVID 19

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr69

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Atrial fibrillation and COVID 19 are two different diseases, but both are upper body issues. Atrial fibrillation is an upper chamber heart issue, while COVID 19 is an upper respiratory issue. Linked together by their disease factors.

Knowing your hearts rhythm and rate is of importance in early detection of atrial fibrillation; just a simple pulse rate check. As for COVID-19, keeping high risk factors at a non-existent level is key, such as high blood pressure. Self-care is a priority.

Two different diseases where early detection and direction is key. For atrial fibrillation, get under a cardiologist in which upon diagnosis, medication or other may be prescribed. And for COVID-19, quick self-care factors are great – wearing a face mask, social distancing and frequency of hand washing is of priority.

Atrial fibrillation is known for being undiagnosed until a person has a heart attack or stroke, but a simple pulse rate check could save your life. Also, knowing what heart rhythm you're in, checking your blood pressure, knowing your numbers. COVID-19 was a world's mystery, but now we know self-care is essential, plus vaccines are available, so put all these things in to practice – frequently washing hands, social distancing, wearing a face mask and being vaccinated.

Knowledge and self-care are the greatest attributes in preventing sudden death because of an undiagnosed disease. Stay involved in your health, learn quick life-saving techniques for personal use and getting care under a good physician is important too. □



Posters 1

70/Effect of AAD pre-treatment on DCCV success rate: A retrospective single centre study

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr70

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C-Y Chan and P Aung are co-first authors

Background: Atrial fibrillation (AF) is a prevalent arrhythmic condition that affects millions of individuals across the globe. Direct current cardioversion (DCCV) is frequently utilized to restore sinus rhythm, but its long-term success rates are not optimal. Recent meta-analysis has concluded pre-treatment with anti-arrhythmic drugs improves acute restoration and maintenance of sinus rhythm after electrical cardioversion. This study aims to investigate whether the efficacy of anti-arrhythmic drugs, particularly amiodarone, in promoting sinus rhythm in patients with AF who have undergone elective DCCV in our centre, is consistent with the results in recent meta-analysis.

Methods: This is a retrospective, single-centre analysis of patients with persistent AF for elective DCCV between January 2022 and March 2023. Patient demographics, medical history, and pharmacologic information were obtained from data record of DCCV clinic. Echocardiographic data, such as left atrial diameter and left ventricular systolic function, were also analyzed.

Results: The outcome indicates no significant correlation between the use of AADs and successful DCCV. No association was found between AAD types, AF risk factors, associated comorbidities, LVEF, LA size and the success of DCCV. However, Chi-Square tests indicate a potential connection between high BMI and success rates in cardioversion, but further research is necessary to determine its significance. According to the group statistics, there is a noticeable difference in the duration of AF (in weeks) between the success rates of DCCV. However, AADs did not have an impact on this difference.

Conclusion: The results indicate no significant correlation between the use of AADs and successful DCCV, which is inconsistent with recent meta-analysis. However, we noticed a significant correlation between the duration of AF and the success rates of DCCV, but AADs did not impact this difference. Further research would be beneficial in determining its significance. □

Posters 1

71/Comparison of atrial fibrillation recurrence rates post-electrical cardioversion in patients with heart failure with reduced ejection fraction with and without amiodarone treatment: Our experience in Buckinghamshire Healthcare NHS Trust

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr71

Authors: *EG Sousa* (Presenting Author) - Buckinghamshire Healthcare NHS Trust, High Wycombe, UK; *S Kaur* - Buckinghamshire Healthcare NHS Trust, High Wycombe, UK; *N Qureshi* - Buckinghamshire Healthcare NHS Trust, High Wycombe, UK; *A Khan* - Buckinghamshire Healthcare NHS Trust, High Wycombe, UK

Introduction: Atrial fibrillation and heart failure often coexist, and are associated with increased morbidity and mortality. Their temporal association may not always be clear, with clinicians often facing a 'chicken-or-egg dilemma'. In this cohort of patients with persistent AF and LV dysfunction, electrical cardioversion is often undertaken to elucidate the aetiology of the LV dysfunction and guide further therapy. Recurrences of AF post cardioversion are common and can be reduced with anti-arrhythmic drugs. NICE guidelines suggest that pre-treatment with amiodarone is considered prior to cardioversion, but do not specify clinical indications where its use would be required as first-line. This could explain a degree of variation in the use of amiodarone pre-treatment in this group noted in the local cardioversion service that led to this retrospective study.

Methods: Retrospective data was collected for patients referred for electrical cardioversion between January 2020 and August 2022 with persistent AF or flutter and LV ejection fraction $\leq 45\%$. We compared the success rate of external DCCV in achieving sinus rhythm acutely and its maintenance at follow-up (8 ± 5 weeks) between the cohorts of patients undergoing cardioversion without amiodarone pre-treatment and patients undergoing cardioversion with amiodarone pre-treatment (including patients that chemically cardioverted following amiodarone initiation and that had a first cardioversion without amiodarone).

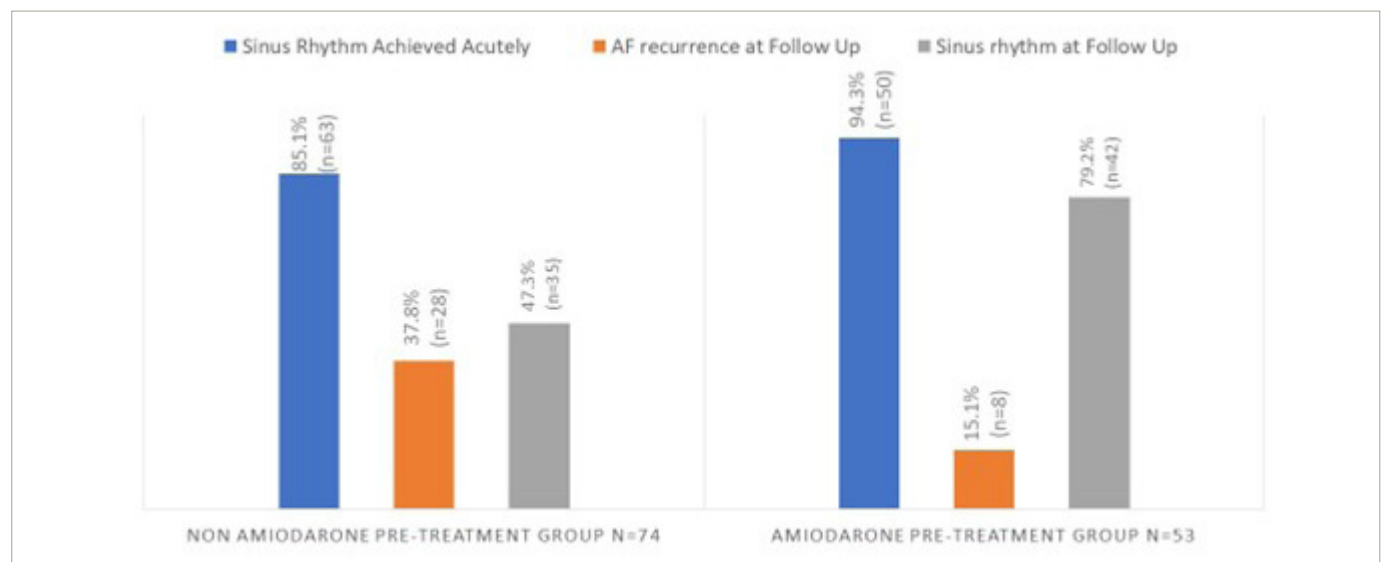
Results: Ninety-nine patients fitted the inclusion criteria. Of these, 79 patients were male and 20 were female. The mean age was 68.2 ± 9.8 years. The mean LV EF at time of referral was $31.7 \pm 7.8\%$. The acute success of cardioversion and rhythm at follow-up are outlined in Figure 1. In the cohort

pre-treated with amiodarone, 7/53 (13.2%) patients achieved chemical cardioversion prior to their external DCCV. Twenty-eight patients (37.8%) not initially pre-treated with amiodarone had a second cardioversion on amiodarone. Twenty-eight out of 74 patients (37.8%) and 8/53 patients (15.1%) in the non-amiodarone pre-treated group and amiodarone pre-treated group respectively relapsed back into AF. There was a statistically significant lower rate of recurrence in patients treated with amiodarone (15.1% versus 37.8%, p-value < 0.05). The relative risk of AF recurrence was 0.36 (95% confidence level, p value 0.001917) when amiodarone was used.

Discussion: This study demonstrated that patients with LV dysfunction are at high risk of early AF recurrence and often require an early repeat cardioversion on amiodarone. A lower relative risk of AF recurrence was observed at the initial follow-up among patients who had cardioversion on amiodarone. First-line amiodarone pre-treatment can lead to earlier maintenance of sinus rhythm, thus abetting earlier diagnosis of LV dysfunction aetiology and support decisions on further treatment. This practice can avoid the need for repeated DCCVs, resulting in more efficient use of NHS resources. In this group, clinical trials such as CASTLE-AF and EAST-AFNET4 demonstrated that rhythm control with catheter ablation leads to improved outcomes. In the current context of long waiting times for catheter ablation, this can be an effective bridging treatment.

Limitations: This was a non-blinded, non-randomized, retrospective, observational study that did not evaluate adverse effects or considered other risk factors for AF recurrence. Thus, further studies into the safety and outcomes of initial amiodarone treatment are needed. □

Figure 1: Graphical representation of acute restoration of sinus rhythm and AF recurrence in groups according to amiodarone pre-treatment





Posters 1

72/The role of having a pre-procedural CT scan for patients requiring pulmonary vein antrum isolation for atrial fibrillation: Redo-ablation probability

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr72

Authors: SBM Mitchell (Presenting Author) - Royal Papworth Hospital, Cambridge, UK

Background: Atrial fibrillation (A-Fib) affects over 33.5 million people globally, being one of the most popular causes for hospitalization. Maintaining sinus rhythm and symptom-free patients is the goal post electrophysiology ablation (EP-Ab). Ideally, a preprocedural computed tomography (CT) should be used to assess left atrial (LA) anatomy, pulmonary vein (PV) sizes and to exclude intracardiac thrombus, though patients do not routinely undergo this pathway, which questions its usefulness in practice.

Methods: This retrospective study included 291 patients (mean age 64 ± 9 years, 64% male), who underwent an EP-Ab either via cryoballoon ablation (CRYO) or multipolar phased pulmonary vein ablation catheter (PVAC) for paroxysmal A-Fib from 2019 to 2022. EP-Ab success was defined after 6–12 months free of A-Fib episodes. Data such as radiation dosage, LA anatomy, PV sizes and procedure information were extracted from medical databases.

Results: A preprocedural CT scan had no relationship to EP-Ab success, nor did gender, LA anatomy and procedure duration. Having a preprocedural CT scan increased the overall radiological exposure ($p=0.014$). Interestingly, out of all the parameters assessed, only left pulmonary vein (LIPV) size had a significant effect on success ($p=0.024$). Furthermore, both left inferior and left superior PV sizes were linked to a higher probability of an unsuccessful EP-Ab ($P=0.037$), along with 1 out of 8 operators showing a 12.2% difference in success rate.

Conclusion: A preprocedural CT can have significant benefit in assessing PV sizes and excluding thrombus, though was associated with excess radiation exposure. Our study observed a significant relationship between the LIPV and success, however, further research in this area could aid optimal procedure technique selection and A-Fib recurrence probabilities. □



Posters 2

73/Safety and effectiveness of an independent nurse-led pathway for pharmacological rhythm control of atrial fibrillation: A single secondary care hospital experience

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr73

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Background: Recent trial evidence suggests an early rhythm control strategy in managing atrial fibrillation (AF) reduces adverse cardiovascular outcomes. ESC guidelines recommend an integrated approach to AF management, including arrhythmia nurse specialist involvement in follow-up. Published data is limited for initiation and long-term monitoring of patients with AF on rhythm control drugs through an independent nurse-led clinic. Further to the success of our multi-disciplinary AF management pathway, in 2019, we introduced an arrhythmia nurse-led pathway for patients with AF opting for pharmacological rhythm control.¹ All patients had access to a telephone helpline and had at least annual follow-up.

Aim: To evaluate short and medium-term outcomes for patients with newly diagnosed AF on pharmacological rhythm control under the independent nurse-led arrhythmia pathway. To evaluate the safety of pill in pocket (PIP) flecainide initiated without in-hospital first dose administration.

Methods: Baseline data was collected prospectively from July 2019 to December 2022 using a standardized pro forma at each visit. Outcome data including cardiovascular mortality, stroke, unplanned AF and/or heart failure (HF) emergency department (ED) attendances and admissions was collected from the electronic patient record.

Results: Of 514 patients with AF seen in the arrhythmia service, 133 were started on medications for rhythm control – 88 on flecainide and 45 on amiodarone. Of these, 121 were under independent nurse-led follow-up – 84 on flecainide and 37 on amiodarone (the rest were seen in joint cardiologist-nurse clinic).

Table 1 describes the cohort baseline characteristics. Twenty-two out of 84 (26.2%) on flecainide were managed with an outpatient PIP strategy, the rest were on regular flecainide (including 12 previously managed with PIP flecainide). All patients on regular flecainide had a baseline ECG and repeat ECG 1–4 weeks post-initiation. The median QRSd and QTc were as follows: QRSd pre-FI = 96 ms versus post-FI 99 ms, QTc pre-FI = 396 ms versus post-FI 402 ms (no significant change). All patients on amiodarone had a baseline ECG and TFTs, and 36/37(97.3%) had baseline LFTs.

All 34 patients who had PIP flecainide were initiated as OP with appropriate education and safety netting. None were hospitalized for supervised administration for first dose flecainide.

Median duration of follow-up was 483 days (IQR: 267–960 days). There was no cardiovascular death or stroke (see Table 1). Twenty-four (19.8%) had an unplanned ED attendance with symptoms related to AF and/or HF, but only 8 (6.6%) were admitted to hospital. No ED attendances were related to adverse effects of flecainide or amiodarone.

Conclusion: Our initial experience shows that an independent nurse-led pathway for pharmacological rhythm control in secondary care setting (without on-site facilities for catheter ablation) was both safe and effective. Medium-term follow-up of around 16 months showed zero adverse events and low rates of hospital admission due to AF. PIP flecainide initiated as OP was associated with no significant adverse events. If replicated in other similar studies, this pathway is likely to be more cost-effective without compromising patient outcomes; especially if rhythm control is more widely used in the future for AF management. □

1. Aslam S, Vickers C, Veevers W, et al. Impact of the introduction of an integrated multi-professional pathway for atrial fibrillation on long-term outcomes. *Eur Heart J*. 2021;42(Suppl.1).

Table 1: Demographic and outcome variables between patients on a rhythm control strategy under independent nurse-led follow up

Table 1: Demographic and outcome variables between patients on a rhythm control strategy under independent nurse-led follow-up						
	Flecainide		Amiodarone		Total	
Patients under Nurse-Led Follow-Up	84		37		121	
Age (years), IQR	61	53-69	71	66-77	66	55-72
Male, %	57	67.9%	27	73.0%	84	69.4%
Coronary Artery Disease, %	0	0.0%	4	10.8%	4	3.3%
LVEF >40%	84	100.0%	36	97.3%	120	99.2%
Baseline Creatinine, IQR	80	71-87	85	75-104	82	71-90
Cardiovascular Death or Stroke, %	0	0.0%	0	0.0%	0	0.0%
AF or Heart Failure Admission, %	2	2.4%	6	16.2%	8	6.6%
AF Emergency Dept Attendance, %	17	20.2%	7	18.9%	24	19.8%
Referral for ablation (discharged), %	15	17.9%	1	2.7%	16	13.2%



Posters 2

74/Repurposing SGLT2 inhibitors as a potential therapy for phospholamban cardiomyopathy

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr74

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Introduction: The phospholamban (PLN) cardiomyopathy is a highly prevalent cause of inherited cardiomyopathies in Dutch populations, caused by a single arginine deletion in the phospholamban gene (PLNR14del), which presents with an early-onset of heart failure and spontaneous lethal ventricular arrhythmias leading to sudden cardiac death. Currently, there is still no effective treatment to prevent or treat the progression of the disease. Therefore, we hypothesize that sodium-glucose cotransporter 2 inhibitors (SGLT2i) such as empagliflozin, which has been recently shown to improve cardiovascular outcomes in patients with heart failure, could rescue contractile dysfunction and decrease the arrhythmogenic risk in PLN cardiomyopathy by direct modulation of calcium/calmodulin dependent kinase II (CaMKII) overactivity.

Explanation of basic methods: We modelled hallmarks of PLN cardiomyopathy, such as impaired contractility and increased calcium transient duration in an in vitro model using human pluripotent stem cell-induced cardiomyocytes (hiPSC-CMs) derived from patients with PLN cardiomyopathy (R14del-hiPSC-CMs) and compared them to their healthy isogenic control (WT-hiPSC-CMs). We treated R14del-hiPSC-CMs and WT-hiPSC-CMs with empagliflozin for 4 days and evaluated the

contractile function and calcium transient time using functional cellular imaging assays. In addition, we studied the effect of empagliflozin treatment on CaMKII phosphorylation by determining protein expression in R14del-hiPSC-CMs and WT-hiPSC-CMs through western blot.

Results: We observed significant restoration of contractile dysfunction and a decrease of elevated calcium transient time in R14del-hiPSC-CMs treated with empagliflozin when compared with WT-hiPSC-CMs. In addition, we identified that non-treated R14del-hiPSC-CMs presented increased levels of CaMKII phosphorylation at baseline with respect to WT-hiPSC-CMs, which significantly decreased after treatment with empagliflozin.

Conclusions/implications: In this study, we have shown that empagliflozin therapy successfully rescued the contractile dysfunction seen in R14del-hiPSC-CM, as well as decreased the elevated calcium transient time by mechanisms involving inhibition of CaMKII phosphorylation. In conclusion, our study contributes valuable insights for repurposing SGLT2i as a new therapeutic strategy to ameliorate contractile dysfunction and decrease arrhythmogenic risk in patients with PLN cardiomyopathy. □



Posters 2

75/Sudden cardiac death in non-elite, competitive footballers in the UK: Incidence rate, preparticipation screening and capacity for emergency response

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr75

Authors: *S Williams (Presenting Author) - Bristol Heart Institute, Bristol, UK; A El-Medany - Bristol Heart Institute, Bristol, UK; C Cowie - The Football Association, London, UK; E Duncan - Bristol Heart Institute, Bristol, UK*

Introduction: Sudden cardiac arrest (SCA) in sport is a tragic event. Elite footballers are at increased risk compared with the general population. The risk in non-elite but competitive individuals is unknown. Rapid response to SCA events is critical to ensure a good clinical outcome. At non-elite, competitive levels of football in the United Kingdom (UK), the availability of automated external defibrillators (AEDs), training of medical personnel in cardiopulmonary resuscitation (CPR) and AED operation has not been investigated. We sought to examine the incidence of SCA in this cohort of footballers, and the capability of clubs to screen players and respond appropriately to SCA.

Methods: Between April and September 2022, a survey was distributed to 1,301 clubs in the men's National League System and the Women's Football Pyramid in the UK. Club representatives were asked whether any of their players had experienced SCA at their home ground in the last 10 years and whether they had a registered player with an implantable cardioverter-defibrillator (ICD). Preparticipation screening, AED availability, medical training of club personnel and availability of an emergency action plan (EAP) were also assessed. When SCA events were identified, further details were obtained directly from the clubs.

Results: Two hundred and eighty clubs returned valid responses (response rate 21.5%), representing 10,868 footballers annually (8,846 male [81%]). Thirteen SCA events from 12 clubs were examined. SCA sufferers were all male and included 5 players. CPR was commenced

in all cases and an AED was used in 11 cases. Of the 13 individuals with SCA, 7 survived, 6 following defibrillation. The SCA incidence rate in players was 1 per 21,728 person-years or 4.6 events per 100,000 athletes. Two players (40%) survived, with at least 1 player returning to play with an ICD.

Preparticipation screening was performed by 14 (5%) clubs. The constituents of screening varied between clubs. Overall, 269 (96%) clubs reported possession of an AED at their home ground with 31 (11%) reporting multiple AEDs. In 237 (85%) clubs, their senior medic was trained in CPR and AED operation. However, 28 (10%) clubs did not know if their senior medics were trained, and in 12 (4%), their senior medic was not trained in CPR or AED operation. EAPs were present in 173 (62%) clubs, however 69 (24.6%) did not have an EAP and 37 (13%) did not know if the club had one. Five (2%) clubs reported a player with an ICD.

Conclusion: The SCA event rate in non-elite competitive players was comparable to elite players in the existing literature. Standardization of medical resources and personnel training is required at non-elite levels of football. The FA have proposed a rollout of minimum medical standards for clubs, commencing from the start of the 2023–24 season. Preparticipation screening was uncommon and constituents of screening were disparate. The vast majority of clubs have an AED at their home ground. Smaller majorities had EAPs in case of an SCA event or had medical personnel trained in CPR and AED operation. □



Posters 2

76/The impact of maximal medication optimization in patients who undergo cardiac resynchronization therapy: A retrospective cohort study at a district general hospital

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr76

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Introduction: Optimization of heart failure medications has a vital role in improving the prognosis of patients with heart failure with reduced ejection fraction even after intervention with cardiac resynchronization therapy (CRT). We sought to determine the extent and impact of drug optimization in patients following CRT at our centre.

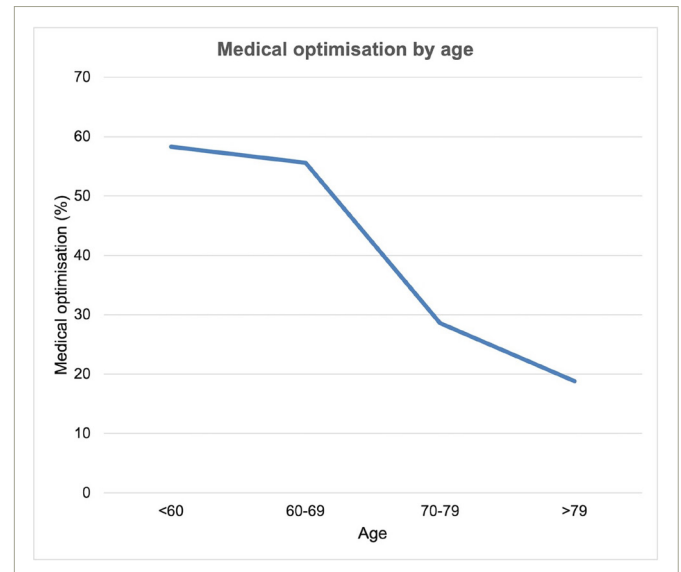
Methods: We conducted a retrospective, observational, quantitative cohort study of patients with a CRT device inserted at a district general hospital in 2014. Our primary outcome was of medication optimization (defined as achieving >50% of the maximum licensed dose of angiotensin blockers [ACEi, ARB, ARNI], beta-blockers [BB] and mineralocorticoid receptor antagonists [MRA]), with a secondary outcome of longevity.

Results: One hundred and eight patients were included in the study, and a total of 732 years of patient follow-up data was analyzed. The average age was 72.8 ± 11.2 years at the time of device insertion, and 39.8% were alive after 9 years.

Achieving higher doses of angiotensin blockers, BB and MRA's all had positive correlations with patient longevity, however only angiotensin blockers were found to have a statistically significant association ($P=0.01$), ($P=0.11$), ($P=0.10$) respectively. In total, 35.2% of patients were medically optimized; optimized patients tended to be younger (75.2 ± 12.6 versus 80.7 ± 8.5 years [$P=0.01$]) and lived longer (6.6 ± 2.9 versus 5.5 ± 3.0 years [$P=0.08$]).

Of the patients included, 47.2% were prescribed all 3 therapeutic agents, 37.0% 2 agents and 15.8% 1 agent. Our data showed a progressive increase in longevity as the number of medications prescribed increased, regardless of the dose ($P=0.01$). There was a negative association between age and the number of therapeutic agents prescribed ($P=0.10$).

Figure 1: Medical optimization by age



Discussion: Our data contributes to the evidence that medication optimization plays an important role in the longevity of patients with CRT devices. Older patients are less likely to receive optimal medical therapy. □

Posters 2

77/Electro-anatomical characterization of leadless cardiac resynchronization therapy

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr77

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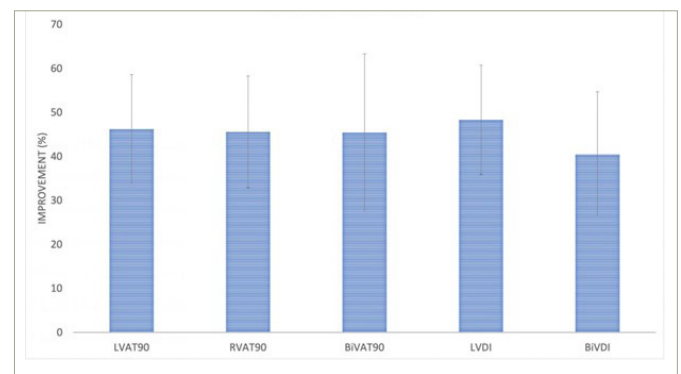
Introduction: Leadless left ventricular (LV) endocardial pacing with the WiSE-CRT System (EBR Systems Inc) is a novel treatment in the field of cardiac resynchronization therapy (CRT). The system was designed to provide lateral wall LV pacing (LVP) in response to detection of a right ventricular pacing (RVP) stimulus from a co-implanted device. The result is biventricular pacing (BiVP) with the RV ahead roughly 30 milliseconds. Observational studies have reported the clinical efficacy of this treatment. However, it is unclear whether BiVP is the optimal pacing modality in these patients, particularly in the context of leadless left bundle branch area pacing (LBBAP), which is an emerging use for this technology.

Aim: We aimed to characterize the electro-anatomical activation patterns of patients receiving leadless CRT at different pacing modalities using electrocardiographic imaging (ECGi).

Methods: Eight patients treated with the WiSE-CRT system underwent an ECGi study. The following pacing modalities were tested: RVP; BiVP; LVP only; and LVP with an electrically optimized atrioventricular delay (AVD) in patients with sinus rhythm (SR). Reconstructed epicardial electrograms from ECGi were used to calculate LV activation time (LVAT-90), RV activation time (RVAT-90), BiV activation time (BiVAT-90), LV dyssynchrony index (LVDI), and BiV dyssynchrony index (BiVDI). For each metric, the percentage improvement compared to RVP was calculated.

Results: Of the 8 patients, 5 were receiving LBBAP via LV septal endocardial pacing; the remaining 3 patients had received lateral wall LVP. The underlying rhythm in 4 patients was SR with left bundle branch block (LBBB), and atrial fibrillation (AF) with complete heart block (CHB) in the remaining 4. At the optimal pacing modality, leadless CRT achieved significant improvements in: LVAT-90 ($46.2\% \pm 12.4$, $p < 0.01$); RVAT-90 ($45.6\% \pm 12.7$, $p < 0.01$); BiVAT-90 ($45.4\% \pm 17.9$, $p < 0.01$); BiVDI ($40.3\% \pm 14.3$, $p < 0.01$) and LVDI ($48.3\% \pm 17.9$, $p < 0.01$), see Figure 1. Overall, BiVP achieved significant improvements in BiVAT-90 ($19.6\% \pm 12.8$, $p = 0.02$) and BiVDI (15.2 ± 12.6 , $p = 0.05$). The optimal pacing modality varied between patients. In patients with SR and LBBB, LVP with AVD optimization was the only pacing modality which was significantly superior to RVP (BiVAT-90

Figure 1: Improvement in activation metric at optimal pacing configuration compared to RV pacing



$43.5\% \pm 11.7$, $p < 0.01$). In patients with AF and CHB, LVP was the optimal modality in 2 patients, with BiVP performing best in the remaining 2. BiVP achieved significant improvements in BiVAT-90 in patients with lateral wall LVP ($39.4\% \pm 13.2$, $p = 0.03$), but not in those receiving septal LVP ($7.8\% \pm 9.2$, $p = 0.07$), where LVP with or without AVD optimization was the best modality in 4 out of 5 patients.

Conclusion: Leadless CRT significantly reduces both electrical activation times and improves electrical dyssynchrony. Whilst BiVP did significantly improve BiV activation and dyssynchrony overall, it was the optimal pacing mode in only 2 patients. In patients with SR and LBBB, LVP with AVD optimization may improve BiV synchrony by allowing LV activation to fuse with native right bundle activation. In patients with septal WiSE-CRT implants, LV activation may be inhibited by a degree of apical septal refractoriness created by the early RVP wavefront. As such, individualized selection of the best pacing modality in each patient may be required with leadless CRT to accommodate for varying conduction disease phenotypes and implant locations. □

Posters 2

78/Between proximal His bundle and left bundle branch: Distal His as a target of physiological stimulation. Preliminary data for His-lead placement during RV-mapping in 13 patients

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr78

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Introduction: Conventional right ventricular pacing can cause left ventricular systolic dysfunction, heart failure symptoms and atrial fibrillation in the long run. Early upgrade to biventricular stimulation or physiological stimulation may be able to prevent these adverse outcomes. His bundle pacing (HBP) has several pitfalls which include lack of capture at acceptable thresholds, incremental threshold values over time, premature battery depletion, poor lead stability with an increased risk for lead dislodgement, inability to identify the perfect pacing position, presence of intranodal block or disease in the distal His bundle, complex procedure with increased fluoroscopy exposition time, oversensing of the atrial electrogram and other technical issues. Deep septal, distal HBP has the potential to overcome some of these issues. There are two ways to perform distal HBP: a primary fluoroscopic approach or the zero fluoroscopic approach by way of 3D high density electroanatomic mapping (EAM).

Methods: Ensite X (Abbott) was used to locate the distal His bundle for pacemaker lead placement with a zero (low) fluoroscopy approach in all patients with right bundle branch block from 7/2022 through 12/2022. A multipolar steerable mapping catheter (Inquiry™ Abbott) was used to create a 3D map of the right heart. Regions of interest were mapped fashioning a venous approach only. During mapping, the His-ventricle intervals were recorded. The C315 catheter (Medtronic) was first placed in the area of interest, and the Select Secure 3830 lead was advanced only to expose the helix. Unipolar mapping was performed to identify the His bundle electrogram. The lead was then advanced into the septum

and fixed. Contrast injection was performed through the deflectable C304His sheath in left anterior oblique 30° fluoroscopic view once. The pacing leads were displayed in the 3D mapping system in unipolar configuration during mapping and in bipolar configuration once the leads were placed. The procedure could include 'ablate and pace' strategy in patients where indicated. Follow-up was 6 months per patient. Primary endpoint was change of threshold during 6 months follow-up. Secondary endpoints included adverse events of all grades.

Results: Thirteen consecutive patients underwent 3D map guided distal His-bundle pacing lead placement with a 92.3% (n=12 patients) success rate at 6-months follow-up. In one case, severe fibrosis led a lead placement in a caudo-lateral position from optimal placement according to 3D map. During follow-up, no lead or procedure-related adverse events could be observed.

Discussion and conclusion: Unlike proximal His bundle pacing, the excitation in the distal His bundle area has been proposed as a viable alternative providing for lead stability, low and stable pacing thresholds, and ability to correct of distal conduction system deterioration. Therefore, distal His bundle pacing has the advantages of stable local ventricular capture and less risk for ventricular pause because of oversensing. The procedure comes with some procedural obstacles, which might be overcome by high density maps of the area of interest. Proper identification of the distal His bundle electrogram during his lead placement by 3D mapping led to successful lead placement with a stable pacing threshold for a 6-months follow-up period in our cohort. □

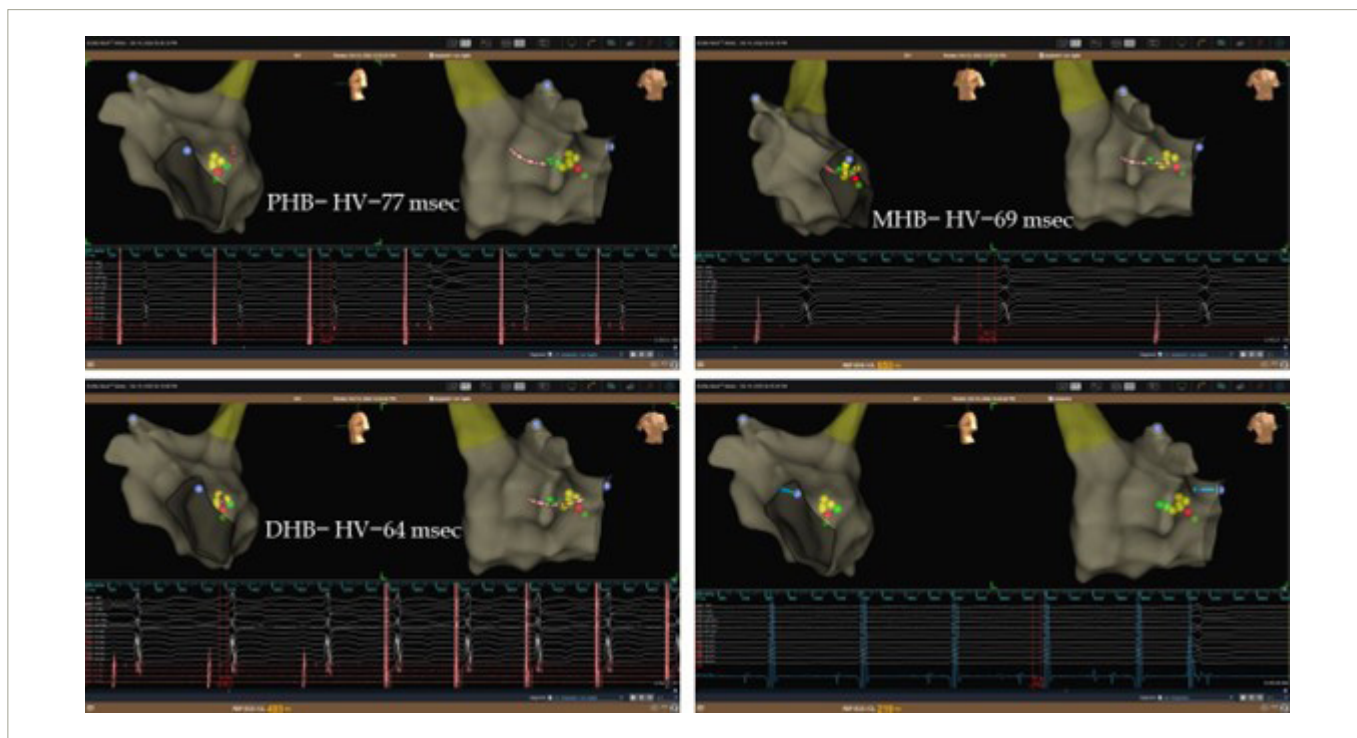
Figure 1



CONTINUED ➡



Figure 2: Maps of proximal, mid and distal His bundle





Posters 2

79/Grover disease associated with pacemaker implantation

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr79

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Case: A 58-year-old male with dual chamber pacemaker implanted 14 years previously for sinus node disease presented with red papular rash and burning pain over pacemaker site. He was initially treated with antibiotics for presumed device related infection. Normal white cell count (WCC) and C-reactive protein (CRP), with negative blood cultures. Rash resolved during admission. The patient represented a few weeks later with similar clinical picture. A transoesophageal echocardiogram and PET CT scan showed no evidence of device infection. Given recurrent presentation, we proceeded to generator explant. No signs on infection on inspection of pocket and device.

Previous pacemaker checks had repeatedly shown low right-ventricular pacing percentages, in light of this, an implantable loop recorder (ILR) was inserted, which subsequently detected clinically significant sinus pauses. Patient incidentally also developed rash around the ILR site and was treated for presumed cellulitis.

A new left-sided pacemaker (St Jude Assurity) was implanted; within a month patient complained of a red vesiculopapular rash over pocket. When reviewed, there were no visible signs of rash or erythema. Patient remained systemically well, with normal inflammatory markers and negative blood cultures. We proceeded to complete system extraction. Lead tips were sent for microscopy and culture did not show any significant growth.

A new pacemaker (Biotronik) was implanted on the right side; within 2 weeks of implant, he represented similar symptoms. As previous, infection screen and repeat CT-PET did not show active infection.

Given the recurrent episodic nature of the flare-ups with significant impairment on quality of life, the right-sided device was extracted and a leadless pacemaker (MICRA) implanted. Symptoms completely resolved on the right side. Unfortunately, the patient sustained traumatic left rib fracture that required internal fixation with metal plates. Subsequently, a rash recurred over the left side of the chest.

The patient underwent a dermatology workup, an initial skin patch test performed and confirmed allergic contact dermatitis to nickel. Skin biopsy showed central areas of epidermal ulceration and inflammation. History, clinical picture, and histology would fit diagnosis of Grover disease.

Discussion: Grover disease, also known as transient acantholytic dermatosis, is characterised by erythematous papular/papulovesicular rash, typically on the trunk. The majority of patients are male, in their fifties and of Caucasian descent. The diagnosis is often clinical, supported by tissue biopsy. Common risk factors are malignancy, fever, sun exposure, hospitalization and being bedridden. It has not previously been described in association with pacemaker implantation.

Device-related rashes are rare and can be misdiagnosed as device-related infection. The relapsing-remitting nature of Grover disease makes diagnosis challenging, as often by the time patients are reviewed by clinicians, the rash has faded. Clinical history is important, lack of systemic symptoms, and absence of positive blood cultures, raised inflammatory markers, and additionally recurrence of symptoms on reimplantation at different site should raise suspicion of noninfective cause. □



Posters 2

80/Inappropriate implantable cardioverter defibrillator (ICD) therapy in remote follow-up patients under the care of Royal Papworth Hospital NHS Foundation Trust

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr80

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Inappropriate implantable cardioverter-defibrillator (ICD) therapies are associated with adverse outcomes. The aim of this study is to determine the frequency and cause of inappropriate therapies in patients under the care of Royal Papworth Hospital NHS Foundation Trust, UK.

All patients with ICDs on remote follow-up between January and December 2021 who experienced therapy were included in this study. Device therapies and arrhythmias were compared by device type and manufacturer. Device settings were compared to the 2019 Heart Rhythm Society consensus on ICD programming.

Single-chamber ICDs and CRT-Ds administered more inappropriate ATP ($p < 0.001$), but not inappropriate shock ($p = 0.155$) therapy, compared with dual-chamber ICDs. Atrial fibrillation and atrial flutter caused more inappropriate therapy ($p < 0.001$) in single-chamber ICDs, and supraventricular tachycardias (SVT) in dual-chamber ICDs and CRT-Ds.

Boston Scientific administered less inappropriate ATP ($p < 0.001$) and shock ($p < 0.001$) therapy, compared with other manufacturers. A significant ($p < 0.001$) cause for inappropriate therapy from Boston Scientific was SVT and atrial flutter from Medtronic. These differences were caused by a small group of patients that experienced numerous therapies; 85.4% of episodes in which patients experienced inappropriate therapy did not follow guidelines for ICD programming.

Dual-chamber ICDs and Boston Scientific had a lower rate of inappropriate therapies, likely a result of the presence of an atrial lead and SVT discriminator limitations. Recommended programming and more robust SVT discrimination, particularly in the VF zone (which is only currently available in Medtronic), could reduce the number of inappropriate therapies. □

Posters 2

81/Physiologic pacing 2.0

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr81

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Introduction: In patients eligible for cardiac implantable electronic device (CIED) placement with the need of a high percentage of ventricular pacing, early indication for CIED placement able to deliver cardiac resynchronization therapy (CRT) is advantageous, because it may prevent a pacemaker syndrome (left ventricular ejection fraction deterioration in patients with apicoseptal right ventricular lead placement and high percentage of ventricular pacing). Bundle branch area pacing are evolving techniques taking the approach of physiological excitation using the heart's intrinsic conduction system. This potentially enables complete cardiac resynchronization without the need for left ventricular lead placement. In current literature, the outcome of physiologic pacing is comparable to pacemakers able to deliver cardiac resynchronization therapy. Compared to upper His bundle pacing, stimulation of the left bundle has a better response, more stable pacing thresholds and better success in correcting pre-existing bundle branch blocks. This is a reason why His lead placement is occasionally supported by mapping of the area of interest. This, however, expands both the procedure time and its complexity. In our case series, we highlight a new approach.

Methods: Every consecutive patient eligible for CRT placement, where coronary sinus (CS) lead placement was not possible underwent right ventricular target area mapping. In order to map the area of interest, the respective lead (which could be a CS lead or a His bundle lead) was implemented into our mapping system ESI NavX (Abbott) by connecting it to the system with an alligator clip (Figure 1) and used as the mapping catheter.

The helix was deployed partially and its tip was used to high-density map the target area. An intracardiac ECG was used to record the cycle length after excitation to identify the optimal position for placement of the lead tip (Figure 2).

The helix was then fully deployed and the respective lead placed. Primary endpoint was change of pacing threshold and RV-LV delay during 12-months follow-up. Secondary endpoints were adverse events of all grades and all-cause mortality.

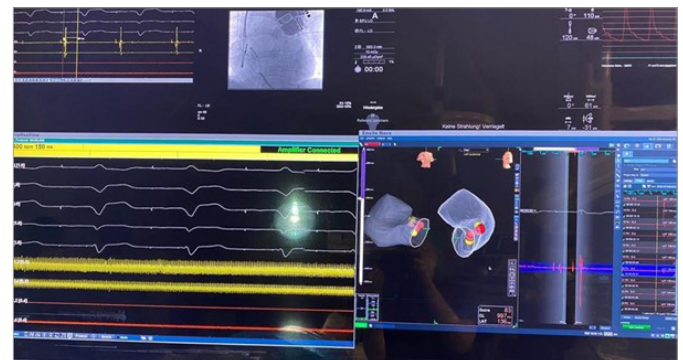
Results: Between March 2022 and January 2023, a total of 8 participants (6 male) aged 79.25 years (73–90) underwent our specific map/pace procedure. Mean procedure time was 80.75 minutes (49–115). Mean follow-up time was 273.5 days (35–458). During follow-up pacing, thresholds were stable in all participants. Altogether, 6 adverse events were observed, unrelated to the procedure or the CIED. One participant succumbed during bypass surgery.

Discussion/conclusions: Physiologic pacing has evolved as an alternative to conventional pacing methods with placement of an RV lead in the anteroseptal position. Specific leads are able to deliver cardiac resynchronization, even without placement of a CS lead. Placing

Figure 1: Alligator clips



Figure 2: Intracardiac ECG and map during lead placement



the lead optimally may be burdensome in terms of finding the 'sweet spot'. Enhancing the response rate via mapping of the left ventricle in case of CS-lead placement or the right ventricle in case of His-lead placement has been reported. Our procedure combines the advantages of being able to map the area of interest for a perfect response rate, and at the same time lowers the procedure time and the cost due to implementation of the lead into the mapping system, when compared with conventional mapping techniques. Our procedure is effective, safe and cost effective. □



Posters 2

82/Impact of fixed-scar and pacing rates on conduction velocity dynamics and wavefront propagation investigated using personalised atrial fibrillation models

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr82

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Background: Structural remodelling is a proposed pathophysiological mechanism in AF, but its impact on electrophysiological parameters remains limited. Personalized computational models include the effects of personalised anatomy and AF remodelling in a framework that can be used to investigate patient-specific AF mechanisms and test treatment response. These models require calibration to electrophysiology data. However, it is unknown how calibration data rhythm, pacing location, and choice of calibration technique influences prediction. We aimed to first evaluate the impact substrate has on conduction velocity (CV) dynamics and wavefront propagation, and second, to use personalized computational models to investigate the effects of CV dynamics on AF wavefront dynamics.

Methods: Local activation times (LATs), voltage and geometry data were obtained from patients undergoing ablation for persistent AF. LATs were collected in sinus rhythm (SR) with coronary sinus pacing at pacing interval (PIs) of 250 ms, 400 ms, and 600 ms. LATs were used to calculate CV dynamics and determine their relationship to voltage. Relationship between enhanced CV heterogeneity sites i.e., rate dependent CV(RDCV) slowing sites ($\geq 20\%$ reduction in CV between PI 600–250 ms of the mean CV reduction seen between these PIs for that voltage zone) and pivot points ($\geq 90^\circ$ change in wavefront propagation) was evaluated. In a subset of cases, personalised anatomical models were constructed and analysed using an automated pipeline using Python. Pulmonary vein isolation (PVI) was simulated in each model after 5 s of AF and wavefront

propagation patterns were analyzed to quantify the number of rotational areas or areas of wavefront break-up in 7 anatomical segments.

Results: Voltage impacts CV dynamics whereby at non-low voltage zone (nLVZ) [≥ 0.5 mV] the curves are steeper, broader at LVZ [0.2–0.49 mV] (0.16 ± 0.09 m/s Δ CV PI1, 0.23 ± 1.1 m/s Δ CV PI2) and flat at very-LVZ (vLVZ) [< 0.2 mV] (0.04 ± 0.01 m/s Δ CV PI1, 0.05 ± 0.02 m/s Δ CV PI2) (Figure 1A). Voltage in AF correlates better with voltage in SR at 250 ms than 600 ms, thereby representing functional remodelling and fixed scar. RDCV slowing sites are predominantly mapped to LVZ [0.2–0.49 mV] (129/168, 76.8%) and frequently co-locate to pivot points (151/168, 89.9%). This is shown in Figure 1B, where blue highlights RDCV slowing sites. Simulated AF wavefront patterns post-PVI varied based on PI used for calibration (Figure 1C). Number of occurrences of rotational activity was higher for the models calibrated to 250 ms than for 600 ms (5.14 and 3.86 respectively). The posterior wall showed the highest number of occurrences per patient with an average of 1.29 at 250 ms and 0.71 at 600 ms.


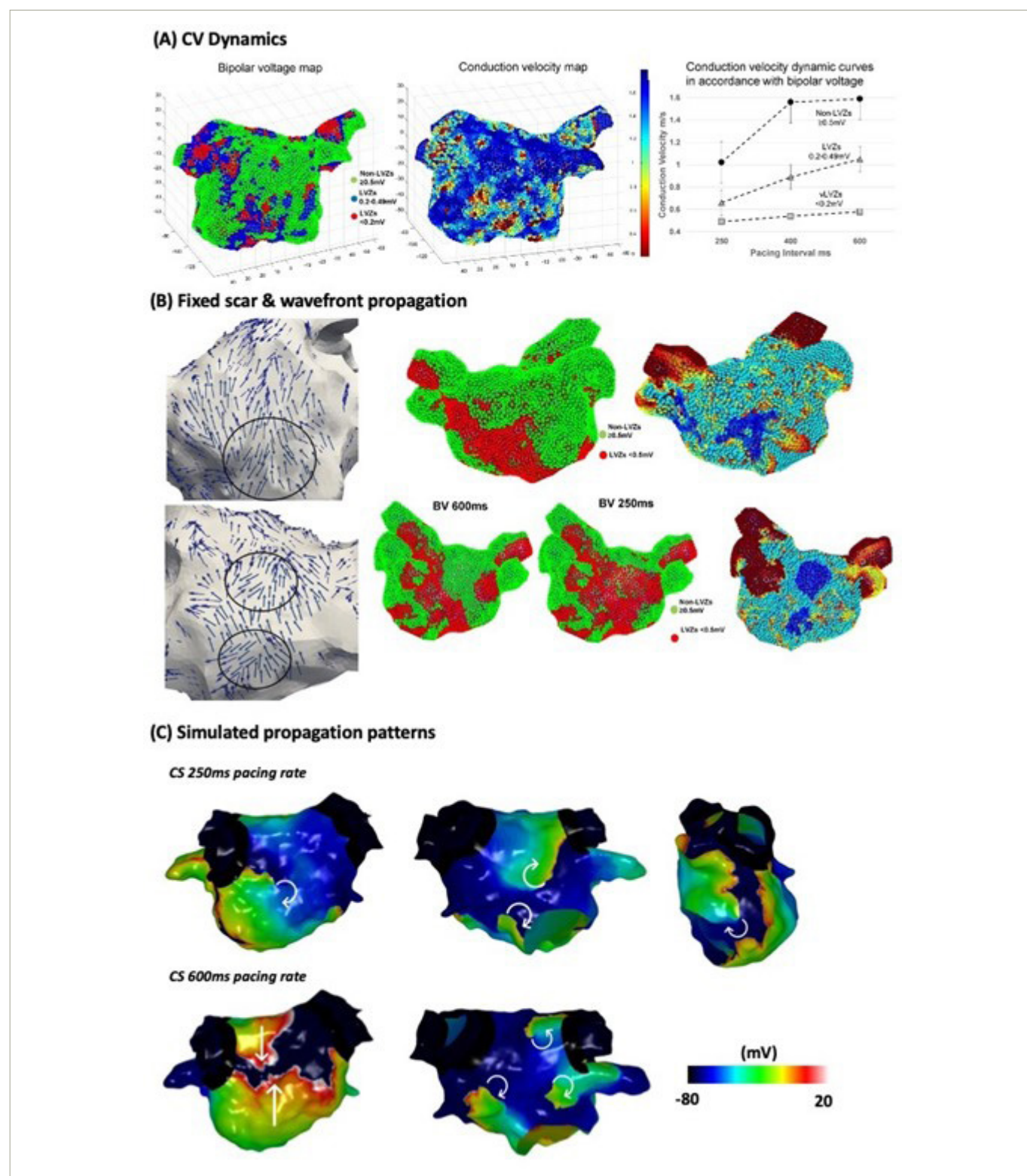
Conclusion: CV dynamics is impacted by scar and functional remodelling, resulting in CV heterogeneity sites correlating to pivot points. Simulated AF properties depend on the choice of pacing rate used for model calibration. Our future work will calibrate personalised restitution properties and compare AF model patterns and predicted therapy outcomes to clinical recordings. This study provides further insight into the pathophysiology in AF. 



Figure 1: Electrogram taken from implantable cardioverter defibrillator interrogation. A: Initial rhythm of V sensing; B: The start of the electromagnetic interference therefore the start of the "VF" detection; C: Trigger point when the device starts to charge and the cessation of the electromagnetic interference





Posters 2

83/Quality of life and mortality in trials of implantable cardiac devices in heart failure: A regression analysis

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr83

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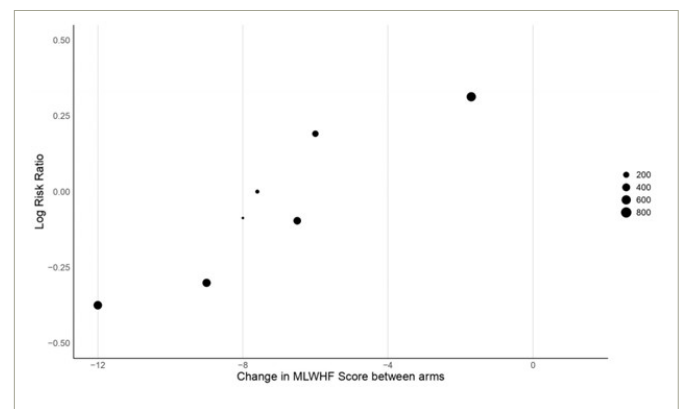
Background: Trials to detect a mortality benefit in heart failure require long follow up periods and large numbers of participants, which is costly and time-consuming. It is quicker and more feasible to assess quality of life. The Minnesota Living With Heart Failure (MLWHF) Questionnaire is one of the most commonly used outcome measures in heart failure research. The relationship between quality of life and mortality in implantable cardiac device trials is not known.

Methods: PubMed was searched for randomised controlled trials up to 10th August 2022 reporting both the change in MLWHF score and mortality. Data was extracted by 2 researchers. The relationship between change in MLWHF score and log risk ratio was assessed using Spearman's correlation coefficient.

Results: Four hundred and twenty records were screened. Seven studies, enrolling 3,078 participants met the eligibility criteria and were included in the analysis. Improved MLWHF score correlated with a reduction in mortality ($r=0.93$, $p=0.002$).

Conclusions: Change in MLWHF score may be a good indicator of prognostic benefit in implantable cardiac devices in heart failure. This could inform future clinical trial design. Further work is required to design even more user-friendly and digital patient-reported outcomes in heart failure device research. □

Figure 1





Posters 2

84/Classification of types of atrial fibrillation activity using RETRO-mapping and application of cycle length as a measure of organization in humans

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr84

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Introduction: We introduced RETRO-mapping as a software for mapping activation during atrial fibrillation (AF). We subsequently suggested features, such as cycle length (CL) and conduction velocity, to detect plane activity. In this work, we suggest an algorithm for automatic classification of wavefronts. We also explore the relationship between CL and degree of organization of activity.

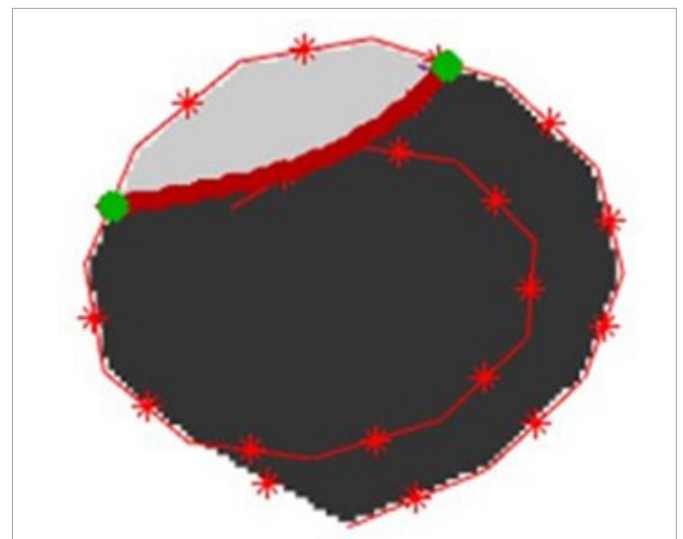
Methods: We recorded electrograms from 9 patients in AF using a 20-pole spiral catheter to create the 2D representation of RETRO-mapping. We defined four types of wavefronts (plane, focal, collision, and rotational), based on the number of endpoints and number of edges. A plane wavefront has a single edge with two endpoints at the limit of the field of view throughout the wavefront, as in Figure 1. For a collision wavefront, the number of edges and the number of endpoints both decrease over time. Focal wavefronts, which have a role in initiating paroxysmal AF,¹ have a single edge but no endpoints, e.g. a circle. A rotational wavefront has a single edge with 2 endpoints, where 1 endpoint is in the centre and the other at the limit of the field of view. Classification results of 48,567 activation edges were validated against a clinician's judgement.

Results: Table 1 gives the percentage of each type of wavefront per case. Patients with persistent AF treated with amiodarone had on average the lowest percentage plane activity. A linear regression between median CL and percentage plane activity returned an R2 value of 0.72. The interquartile range of CL was significantly higher for patients with persistent AF treated with amiodarone (the same patients with lower plane activity).

Conclusions: We can use the number of edges and endpoints to classify the type of wavefront using RETRO-mapping. A higher interquartile range of CL correlates to less plane activity, thus may be a measure of disorganization in AF and the effect of amiodarone could be evaluated against current literature findings.² As this was an initial study of 9 patients, a larger study is needed to validate our initial results. □

1. Takahashi Y, Iwai S, Yamashita S, et al. Novel mapping technique for localization of focal and reentrant activation during atrial fibrillation. *J Cardiovasc Electrophysiol*. 2017;28:375–82.
2. Fynn S, Todd D, Hobbs W, et al. Effect of amiodarone on dispersion of atrial refractoriness and cycle length in patients with atrial fibrillation. *J Cardiovasc Electrophysiol*. 2003;14:485–91.

Figure 1: A sample field of view of RETRO-mapping showing a plane activation edge



Endpoints are shown in green, and the edge is shown in dark red.

Table 1: The percentages of wavefront type

Patient	Plane	Collision	Focal	Rotational
1	76%	2.6%	0.12%	21%
2	98%	0.56%	0.094%	1.1%
3	94%	5.2%	0	1.3%
4	76%	2.5%	0.36%	21%
5	71%	2.1%	0.089%	27%
6	80%	1.9%	0.14%	18%
7	92%	1.2%	0.047%	7.1%
8	91%	1.2%	0	8.0%
9	87%	1.5%	0.024%	12%

Three patients had paroxysmal AF (blue), 2 had persistent AF treated with amiodarone (red), 4 patients had persistent AF without amiodarone treatment (green).



Posters 2

85/Wearable medical device enables ECG recording at the time of symptoms, capturing episodes of Wolff-Parkinson-White syndrome that single ECG recordings miss

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr85

Authors: [FS Singleton](#) (Presenting Author) - CardioLogic, York, UK

Disclosures: Declaration of conflict of interest, as CardioLogic distribute CardiacSense in the UK.

Introduction: The unpredictable and sporadic nature of arrhythmias can cause a challenging diagnosis during a single ECG test. Often a more comprehensive method to detect an arrhythmia is necessary. Wearable cardiac devices, such as the CardiacSense watch, have the ability to continuously monitor heart rate. CardiacSense also enables patients to record an on-the-spot ECG when they feel symptoms.

Methods: The patient has been experiencing episodes of palpitations, describing an increased heart rate, since November 2022. These events last up to 30 minutes and occur multiple times a day. Following these symptoms, the patient sought medical attention, attending A&E during another episode of palpitations. The patient reports that during the wait for medical advice at A&E, their palpitations subsided. Subsequently, during the ECG recording that the A&E department initiated, no abnormalities were revealed and the patient was dismissed. As symptoms restarted a day later, a further ECG test was completed at the patient's general practice (GP) surgery.

The patient typically feels palpitations in the afternoon or evening time; therefore, as anticipated at their 7 am ECG appointment, no symptoms were felt and again the ECG test displayed no abnormalities. The symptoms were attributed to anxiety, rather than a cardiac condition.

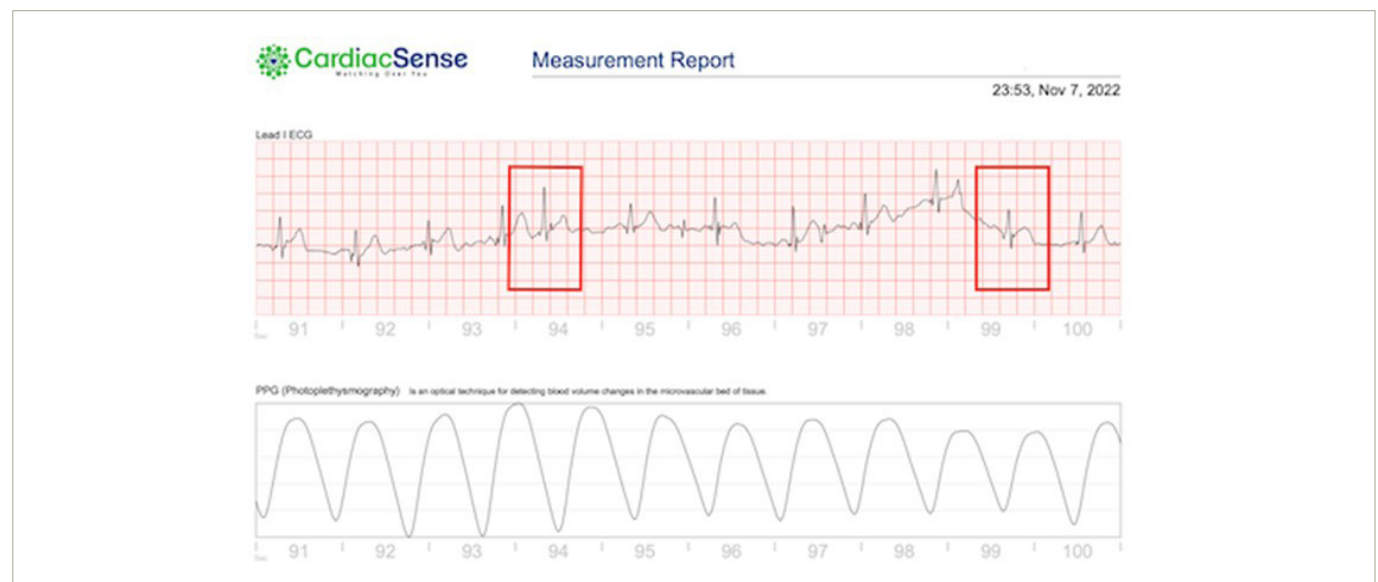
The patient decided to purchase a CardiacSense watch (Figure 1) and was able to record an on-the-spot ECG test whenever they felt palpitations. Over the course of a week, whenever the patient felt palpitations, they initiated multiple ECG tests by selecting 'record ECG' on the device home screen and placing their thumb and index finger on the watch's ECG sensors. The CardiacSense reports are immediately available to view via the mobile application.

Figure 1: The CardiacSense medical watch



Results and conclusions: The ECG reports generated by the CardiacSense watch were analyzed by the patient's GP. Four of the CardiacSense ECG reports displayed abnormal tracings (Figure 2), with results indicative of Wolff-Parkinson-White syndrome. The GP has since referred the patient to a specialized cardiac unit for further evaluation and treatment. This case study report signifies the potential of wearable devices to take ECG recordings during palpitations, which may enhance the detection of arrhythmias that are unable to be diagnosed with a single ECG recording. □

Figure 2: Page 10/23 of CardiacSense report showing slurring upstroke 'delta' wave



Posters 2

86/Early experience of conduction system pacing in a district general hospital

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr86

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Background: Conduction system pacing (CSP) can be achieved with His bundle pacing (HBP) or left bundle branch area pacing (LBBAP). Both result in physiological activation of the ventricles, but LBBAP is perceived to be technically easier and result in more reliable sensing, with lower thresholds. Acute and medium-term experience of CSP in district general hospitals has not been reliably studied, and this is vital if we are to adopt CSP for different pacing indications. Here we present our early experience of CSP.

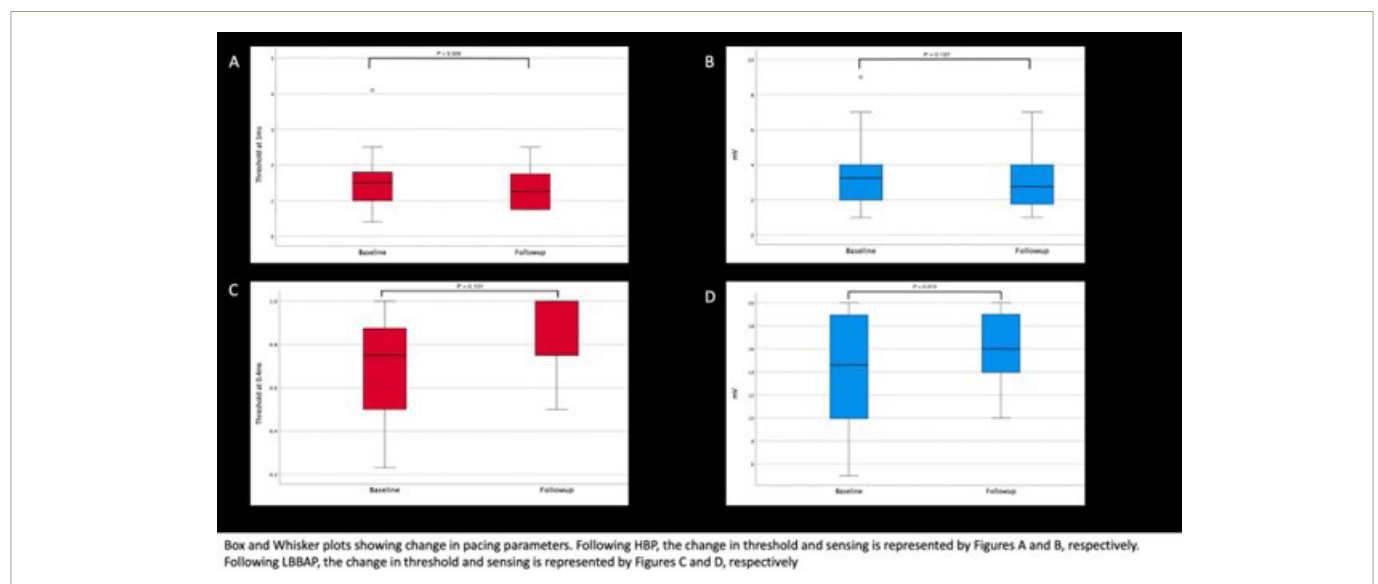
Method: Patients underwent CSP if they had an indication for pacing for bradyarrhythmias and not if they met criteria for cardiac resynchronization therapy. Implant data, acute and chronic complications and pacing follow-ups were recorded. CSP was conducted according to previously defined criteria. Selective HBP was confirmed by an equal stimulus and His-QRS with isoelectric interval, single capture threshold and discrete local ventricular electrogram in HBP lead. LBBAP capture was assessed according to previously defined criteria, briefly; during unipolar-tip pacing there was evidence of right bundle branch morphology and a constant V6 peak left ventricular activation time of <80 ms at 5 V and 1 V or transition from non-selective to selective left bundle branch capture at near-threshold outputs.

Results: Thirty-six patients underwent CSP: 22 HBP, and 14 LBBAP. Baseline demographics included: 74 ± 10 years, 69% male, intrinsic QRS duration of 108 ± 20 ms and left ventricular ejection fraction of $51 \pm 12\%$. The indications for pacing included 23 (64%) patients with high-degree atrioventricular block, 11 (30%) patients with sinus node disease, 1 (3%) was scheduled for an atrioventricular nodal ablation

for rapidly conducted atrial fibrillation and 1 (3%) was enrolled in the HOPE-HF study. HBP was successful in 18 (82%) patients and LBBAP in 13 (93%), as we were unable to achieve CSP according to the pre-defined criteria in the remaining patients and therefore they were implanted with an endocardial right ventricular lead. There were no acute complications in either group. In the HBP group, the baseline sensing was 3.7 ± 2 mV and threshold was 1.5 ± 0.9 V at 1 ms and HBP resulted in a similar paced QRS duration compared with intrinsic rhythm (109 ± 24 versus 108 ± 20 ms; $P=0.880$). Patients were followed-up for 27 ± 16 months, and HBP was present in all patients except one, as they lost HBP capture following an atrioventricular nodal ablation. There were no other chronic complications. There was no significant difference in sensing (3.25 mV; $P=0.197$) or threshold (1.4 V at 1 ms; $P=0.569$), compared with implant. In the LBBAP group, the baseline sensing was 14 ± 6 mV and threshold of ≤ 1 V at 0.4 ms. There was no significant difference in the paced and intrinsic QRS duration (109 ± 16 versus 111 ± 22 ms; $P=0.944$). There were no acute complications. At 3 months, there was no significant difference in the sensing (16 mV; $P=0.313$) or threshold (0.8 V at 0.4 ms; $P=0.101$) compared with implant. There were no chronic complications.

Conclusion: We have demonstrated that CSP can reliably be undertaken for patients with bradyarrhythmias. Although LBBAP resulted in better sensing and lower thresholds compared with HBP, both parameters remained stable during extended follow-up. These results support the role for undertaking CSP in district general hospitals, and this will potentially lead to improved patient outcomes, compared with conventional pacing. □

Figure 1: Box and Whisker plots showing change in pacing parameters





Posters 2

87/A review of implanted cardiac defibrillators in paediatric patients at Alder Hey Children's Hospital

European Journal of Arrhythmia & Electrophysiology. 2023;9(Suppl. 1):abstr87

Authors: T Smith (Presenting Author) - Alder Hey Children's NHS Foundation Trust, Liverpool, UK; L O'Connell - Alder Hey Children's NHS Foundation Trust, Liverpool, UK; K Spelman - Alder Hey Children's NHS Foundation Trust, Liverpool, UK; M Bowes - Alder Hey Children's NHS Foundation Trust, Liverpool, UK

Introduction: Implantable cardiac defibrillators (ICDs) are a lifesaving therapy for children at risk of life-threatening arrhythmias. Often, such children will present with sudden cardiac arrest, and ICDs are vital for secondary prevention of further life-threatening events. If high-risk young patients are identified early, ICDs can ideally be implanted for primary prevention.

Method: We performed a search of our patient database to identify all children referred to Alder Hey Children's Hospital for ICD insertion between January 2017 and June 2023. We reviewed the case notes of all patients with an ICD implanted and collected data relating to underlying diagnosis, follow up, shocks delivered and complications.

Results: We identified 17 patients with ICDs during the 6-year period; 14 (82%) of which were inserted for secondary prevention following sudden cardiac arrest; the remaining 3 (18%) for primary prevention. In the overall cohort of patients, there were 9 males (53%) and 8 females (47%). Patients ranged from 6–15 years at the time of implantation (mean age 10 years, 7 months) and mean bodyweight at implantation was 43.9 kg. The most common diagnosis was long QT syndrome, affecting 6 patients (35%).

All devices were in situ for at least 13 months, with a mean time from implantation of >3 years (38 months). Patients received a total of 239

face-to-face follow up appointments, which equates to 5 face-to-face follow up visits per patient per year of implantation. A further 751 remote CareLink follow ups were performed.

In total, 25 shocks were delivered to 3 different patients, all 3 of whom had different subtypes of long QT syndrome. One single patient with long QT type 68 received 22 shocks during the study period. We identified 2 inappropriate shocks delivered to a single patient, both as a result of atrial flutter. The rate of inappropriate shocks during this study period was calculated at 1 shock per 9,885 implanted days. We found zero lead complications and zero ICD extractions amongst our patients.

Conclusions/implications: This study identifies long QT syndrome as the highest risk patient group for ICD use and suggests that these patients should be a particular focus for follow up.

We believe that our overall shock rates were low because of close patient surveillance through regular face-to-face follow ups and home monitoring. Patients received on average 5 follow up clinic visits each year with review of height, weight, clinical status and medication, leaving little opportunity for their medical status to deteriorate. Inappropriate shock rates were very low, and delivered to only 1 single patient as a result of atrial flutter. Along with our zero complications, this demonstrates the success of our intensive follow-up programme. □



Posters 2

88/'AssistMed' project: A natural language processing tool for rapid atrial fibrillation cohort characterization from textual data in electronic health records

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Background: Adoption of electronic health records (EHR) improved the availability of medical documentation for research purposes. However, significant proportion of data is in textual information that cannot be utilized for scientific purposes until it is analyzed through manual chart review. Utilization of only structured data from EHR is insufficient for comprehensive cohort characterization and of variable quality. Natural language processing can be utilized to unlock valuable data from textual format.

Purpose: We developed a comprehensive text-processing tool for cardiology field. The algorithm employs advanced text processing based on a specifically designed, vast database of medical terminology, drug lists and echocardiography parameters with data structure tailored to the needs of clinical researchers. The algorithm can automatically analyze 3 types of textual data which are universal parts of discharge summary in Poland: (1) descriptive medical diagnoses; (2) discharge recommendations; (3) echocardiography report (if performed). Set of discharge summaries was analyzed with both the conventional (manual) method and the algorithm to demonstrate the process of acquisition of basic characteristics of the cohort of patients with atrial fibrillation/flutter.

Methods: Discharge summaries (validation dataset) of 400 patients hospitalized at one cardiology department were analyzed (1)

automatically and (2) manually coded into database by a healthcare professional, utilizing proprietary developed annotation tool to accelerate annotation process, minimize errors and calculate total effective data acquisition time.

Results: The time of manual and automatic data analysis was 13:08 and 0:21 hours, respectively. The overall macroaveraged F1-score for automatic detection with manual detection as a reference was: 0.924 for diagnoses, 0.983 for drug groups and 0.988 for echo parameter retrieval indicating high agreement. Some differences between the 2 classifications were noted, but did not reach statistical significance. There were total of 181 errors, within a total of 9,535 identified parameters (diagnoses, medical substances, or echo parameters) analyzed. Manual qualitative analysis revealed 65.8% of them related to random algorithm errors, 21.5% to manual annotation errors and 12.7% errors related to a lack of advanced context analysis.

Conclusions: The utilization of the algorithm greatly reduced the time required for basic characteristics of the group acquisition without significantly compromising the quality of the data. Automatic detection of retrospective study cohort through application of text processing techniques from electronic health records is promising and feasible. Further progress can be made with utilization of large language models due to superior context awareness. □

Figure 1

The screenshot displays the AssistMed web application interface. At the top, there is a navigation bar with the logo and menu items: 'Moja praca', 'Pulp', 'Recordsety', 'Anotacje', 'Administracja', and 'O projekcie'. The main header shows 'AssistMED' and a user profile icon 'CM'. Below the header, the page title is 'Klasyfikacja' with a subtitle 'Recordset "EHRA, Z zaburzeniami rytmu serca"'. A timer indicates 'Czas pracy: 00:00:00'. The interface includes a search bar with 'Rekord: 5352' and buttons for 'POPRZEDZ', 'NASTĘPNY', and 'Tylko do zrobienia'. There are three tabs: 'ROZPOZNANIE' (selected), 'LEKI', and 'ECHOKARDIO'. The 'ROZPOZNANIE' tab shows a list of diagnoses with a table structure:

Rozpoznanie	Auto (79)
NIWYDOLNOŚĆ_SERCA	✓
KARDIOMIOPATIA_ROZSTRZENIOWA	✓
TERAPIA_RESYNCHRONIZUJĄCA	✓
KARDIOWERTER_DEFIBRYLATOR	✓
MIGOTANIE_PRZEDSIENKOWE	✓
NADCIŚNIENIE_TĘTNICZE	✓
CUKRZYCA	✓
CUKRZYCA_TYPU_2	✓
POCHP	✓

To the right of the table, there is a box titled 'Opis rozpoznanych chorób' containing a detailed description of the patient's condition in Polish, mentioning 'Niewydolność serca', 'kardiomiopatia rozstrzeniowa', 'LBBB', 'Stan po implantacji układu CRT-D', 'Napadowe migotanie przedsieniowe', 'Nadciśnienie tętnicze', 'Cukrzyca typu 2', and 'POCHP'. The footer of the application shows '© 2022 Copyright: Warszawski Uniwersytet Medyczny'.



Posters 2

89/How effective are vagal manoeuvres at terminating supraventricular tachycardia episodes?

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Introduction: There are currently no FDA-approved drug therapies for use in the at-home setting for an acute treatment of sustained supraventricular tachycardia (SVT); therefore, vagal manoeuvres (VM) are recommended in some patients with SVT to increase parasympathetic tone to terminate the arrhythmia. However, the efficacy of VM has not been previously well-reported.

Objective/purpose: To determine the effectiveness of pre-trained VMs to resolve SVT episodes outside of a supervised setting.

Methods: Patients with a documented history of SVT were enrolled in a randomized, placebo-controlled trial of etripamil nasal spray (ClinicalTrials.gov identifier: NCT03635996) to assess safety and efficacy of SVT conversion to sinus rhythm. At enrolment, patients were trained to perform a VM and were instructed to do so upon perceiving SVT, after affixing an ambulatory electrocardiographic (ECG) system but prior to using study drug. If VM was unsuccessful for SVT termination, patients self-administered drug. Blinded ECG data were adjudicated by an independent committee. Efficacy endpoints included assessing SVT

episodes converted to sinus rhythm by VM. Analyses used descriptive statistics.

Results: One hundred and sixty-nine patients with SVT were enrolled, median age (range) = 61 years (21–90), 62% female. VM were performed for 190 confirmed SVT episodes, leading to termination in 2.6% (5 episodes, n=4 patients) over a median follow-up (range) of 232 days (8–584).

Conclusion: VM alone terminated 2.6% of confirmed SVT episodes. These findings show a low efficacy of VM to acutely terminate SVT episodes.

Implications for practice: This controlled trial provided real-life evidence for the effectiveness of VM after the identification of SVT by patients' symptoms. By obtaining these insights into patients' use of VM, we can provide evidence-based patient education of realistic expectations of the low effectiveness of VM to acutely terminate patients' SVT episodes. Patients struggle with managing their SVT episodes and there is an unmet need for effective, ambulatory, acute treatments. □